144263

SITE INVESTIGATION/ FEASIBILITY STUDY

FOR

CREEK SEGMENT A

JUNE 1990

VOLUME I

SITE INVESTIGATION/
REMEDIAL ALTERNATIVES EVALUATION
for
CREEK SEGMENT A

VOLUME I

March 1, 1990

Letter of Transmittal

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1.0 INTRODUCTION

The Avendt Group, Inc., was retained by Lowenstein, Sandler, Kohl, Fisher & Boylan to perform a Site Investigation and Remedial Alternatives Evaluation at Creek Segment A, located in Sauget, St. Clair County, Illinois. The Site Investigation portion of the study was performed to fully evaluate Creek Segment A (CS-A). The information gathered through this portion of the project was utilized to evaluate alternatives for the remediation of CS-A. This study presents the results of the site investigation in Volume I, and the results of the Remedial Alternatives Evaluation in Volume II.

1.1 Study Objectives

The objectives of the Site Investigation and Remedial Alternatives Evaluation are:

1. Research the historical uses of CS-A.

2. Characterize and define the constituents in CS-A and determine the volume of sediments requiring action.

3. Identify and evaluate the methods feasible for the remediation of CS-A which is consistent with the National Contingency Plan (NCP).

4. Recommend a remedial alternative which is consistent with the NCP.

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2.0 SITE CHARACTERISTICS

2.1 Site Location

CS-A is located on the eastern one-third portion of Cerro Copper Products Co. property, which is located on Illinois Route 3 in the Village of Sauget, St. Clair County, Illinois, across the Mississippi River from St. Louis, Missouri (Plate 1).

The site is defined by the visible banks of CS-A.

2.2 Operational History

2.2.1 Site Ownership

Cerro Copper Products Co. and its predecessors purchased the site in stages beginning in 1927, and ending in 1969, with ownership to the center of CS-A accompanying the ownership of adjoining property. Land on the west side of CS-A, including a portion of CS-A, was purchased in 1927 and 1948, by predecessor owners, the Lewin Metals Company and Lewin-Mathes Company, respectively. The latter sold the property to Cerro de Pasco Corporation in 1957, which went through a series of corporate reorganizations leaving Cerro Copper Products Co. as current owner.

Land along the east side of CS-A, including the remaining portions of CS-A, was acquired in 1955 from the Sauget family, in 1967 from Rogers Cartage Company, and in 1969 from Harold Waggoner and Lillie Mifflin.

2.3 Site Use

2.3.1 Description and Past Uses

The legendary history of Dead Creek is as a man-made drainage path originating to the north of CS-A. Various documents establish that the drainage path extended at least 600 feet north of the current boundary onto Monsanto property and the Site received flow from the northern section (Agreement Alton & Southern Railroad Company and Monsanto Chemical Works with the Village of Monsanto; October, 1939). This northern portion on Monsanto property was subsequently filled in. At another point in this history, the Village of Sauget plugged the southern outflow of CS-A and thereafter CS-A drained exclusively to the north into the Village sewer system.

CS-A receives runoff of stormwaters and drains into a pipe at its northern terminus into the Village sewer system (Figure 1). The CS-A drain system was designed to provide for backflow of effluent from the Village system into Creek Segment A. Hence, Creek Segment A has received, in addition to stormwater runoff, backflow of sanitary and industrial effluent from the Village sewer system.

2.3.1.1 Industrial Discharges

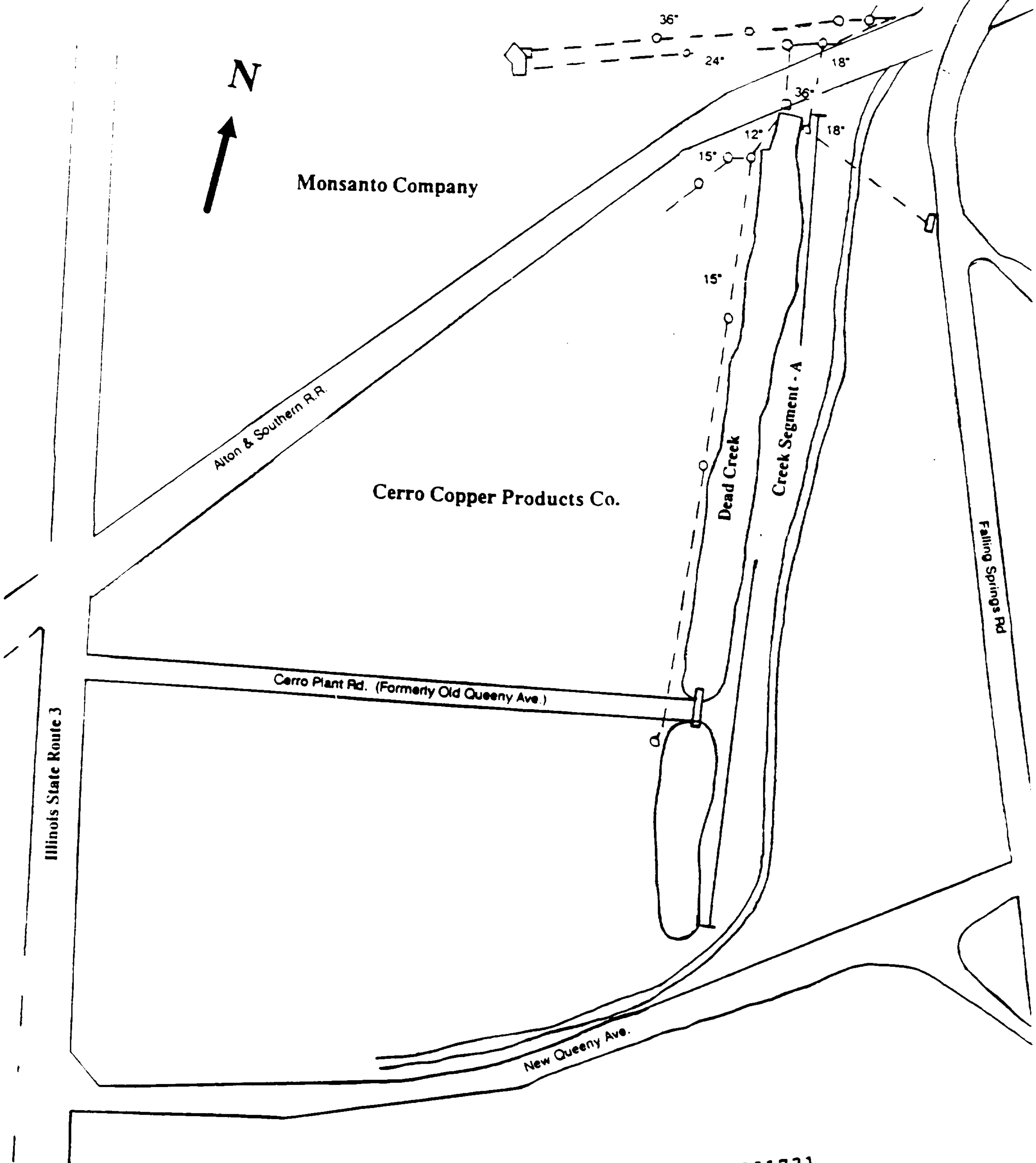
According to E&E (Ecology & Environment, May, 1988, pg. IA-1), "Creek Segment A received discharges from Monsanto and other companies prior to 1970." (Figure 1). E&E had no specific information as to the constituents of these industrial discharges.

2.3.1.2 Sanitary Discharges

CS-A received sanitary discharges through two sources. The first is a Village combined sewer overflow located at the northern terminus, which was plugged in 1989. The second is combined sanitary/industrial back flow through the existing 36-inch pipe located under the Alton and Southern Railroad tracks (Figure 1).

Figure 1: Site Location Map

This diagram shows the location of Creek Segment - A on the Cerro Copper Products Co property as well as the location and size of storm and sanitary/industrial sewers



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2.3.2 Description of Current Uses

2.3.2.1 Utilization for Stormwater Retention

In addition to the surcharges described above in Sections 2.3.1.1 and 2.3.1.2, drainage to CS-A are area runoff and roof drainage from Cerro Copper Products Co., through runoff drain pipes projecting from the west bank. When the water level in CS-A rises, the water discharges through a 36-inch pipe to the Village sewer system, which ultimately drains to the Sauget Wastewater Treatment Plant. The Village of Sauget recently sealed the overflow opening of its combined sewer manhole that is near the north end of CS-A to prevent sanitary or combined industrial sanitary waste from entering CS-A via that route.

2.3.2.2 Temporary Recharge Basin for Dewatering Operations

Cerro has under current construction a stormwater interceptor system as described in Section 3.3. During the construction of the Cerro stormwater interceptor system (sewers, detention basin and pumping station) the areas of construction will be dewatered as a result of a high groundwater table located in the construction zones. Seven dewatering wells have been placed along the construction zones approximately 35 to 40 feet deep. Each dewatering well has a capacity to pump approximately 750 gallons per minute. Only those wells adjacent to the current working areas are pumped during construction. The groundwater pumped from these wells is being directed to CS-A. As a result of the dewatering operations, CS-A is acting as a temporary recharge basin to this area and also as a conduit for the water to flow to Sauget's Wastewater Treatment facility during construction of the stormwater facilities.

2.4 Access Restrictions

2.4.1 Cerro Property

Access to Cerro Copper Products Co. is restricted by a combination of barrier fences and a 24-hour security system. The fence extends around the entire perimeter of the Cerro property. This limits access only to secured gates.

These security measures have been supplemented by the installation of a closed-circuit television monitoring system throughout the property. The cameras are mounted on poles at strategic locations throughout the property, giving remote sensing capability to the security personnel.

2.4.2 Creek Segment A Access Restrictions

In addition to the access barrier around the Cerro property, a fence was erected around both sections of CS-A in September, 1989. These fences encircle the entire perimeter of the creek sections and leave up to a 40-foot barrier between the creek bank and the fence line. Access to the creek sections is limited to the gates along the roadway that divide the two sections, except when portions of the fence are temporarily dismantled for construction access. Otherwise, these gates are locked at all times.

2.5 Current Surrounding Land Use

2.5.1 Industrial Characterization

The predominant land use in the area surrounding CS-A is heavy industrial with some commercial, agricultural and residential areas interspersed throughout the vicinity. Industrial sites that surround Cerro Copper Products Co., and consequently CS-A, include a rail line for the Alton and Southern Railroad, Monsanto Krummrich Plant, and Big River Zinc to the north; Sterling Steel Foundry and Mobil Oil tank farm to the northeast; Wiese Planning and Engineering Company, Metro Construction Company and Keeley Construction Company to the south, though land usage is unknown for these sites; Midwest Rubber Company, a rubber reclaiming facility, to the southwest; and the Sauget Wastewater Treatment Plant, Trade Waste Incineration, a hazardous waste incinerator, and Clayton Chemical Company, a solvent recycling facility to the west.

2.5.2 Residential Population

CS-A is located within the Village of Sauget, Illinois which has a population of 205, according to the 1980 census.

2.6 Groundwater Usage

Information regarding groundwater usage in the Sauget area is based on the findings of the E&E report (E&E, May, 1988), and is summarized as follows:

2.6.1 Current Groundwater Usage

There are currently few demands for groundwater in the Sauget area. The primary source of drinking water for area residents is an intake in the Mississippi River approximately three (3) miles north of the Sauget area. The E&E report indicated that the total current groundwater pumpage was estimated to be less than 0.5 mgd.

2.6.2 Historical Groundwater Usage

Groundwater withdrawals increased in the Sauget area from approximately 100,000 gpd in 1905, to a high of 35.5 mgd in 1962. The withdrawals have gradually declined as a result of conservation; the closing of two major groundwater using facilities; and the conversion of some industrial facilities from the use of groundwater to public water supplies.

2.7 Site Topography

CS-A is located in the southwest portion of the Springfield Plain within the Till Plain portion of the Central Lowland Province of Illinois. The Springfield Plain is a flat till plain which consists of glaciated till material from the Illinoisan ice age period. The till plain consists of morainic and flood plain features which include broad and flat swampy areas, terraces, curved ridges and swales, and oxbow lakes.

The region encompassing the CS-A site is known as the American Bottoms, or valley bottom of the Mississippi River. The physiographic features in the area are controlled by bedrock structures. The American Bottoms is defined by the high bluffs located on the east side of the river.

The geologic formations within the region consist of an unconsolidated alluvium and glacial outwash, underlain by Mississippian and older bedrock layers. These rock layers are underlain by crystalline granite rock of Precambrian age. CS-A, the American Bottoms, the Mississippi River and associated tributaries are situated in a large, deeply cut bedrock valley highlighted by high bluffs on both sides. The Mississippi River has been the dominant factor which has controlled the formation of geology and hydrogeology within the region surrounding the site. However, glaciation during the Quaternary ice age has also played a role in the geological developments in the area.

Unconsolidated material within the Mississippi River cut valley ranges in thickness from 70 to 120 feet in the project area. The unconsolidated material consists of two formations, the Cahokia Alluvium and Henry Formation. The Cahokia Alluvium consists of silty sands and sandy silts. The Henry Formation consists of medium to coarse sands and gravel.

2.8 Regional Climatic Conditions

The regional climate in the site area is continental, with hot, humid summers and mild winters, occasionally interrupted with extremely cold periods of short duration. The project area is located in an area where cold fronts converge from the north and warm moist fronts converge from the south. This zone of frontal convergence produces a variety of rapid changes in weather conditions.

The average precipitation in the project area is 35.4 inches per year. June is normally the wettest month. The average annual temperature is 56 degrees fahrenheit with a January mean temperature of 32 degrees F and a July mean temperature of 79 degrees F.

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3.0 SITE INVESTIGATION

3.1 Previous Work (E&E Investigation)

The following Findings and Conclusions concerning CS-A have been taken directly from the E&E Report, May, 1988. Relevant portions concerning CS-A have been excerpted from the E&E Report.

3.1.1 Findings

Creek Sector A

"Historical aerial photographs indicate evidence of waste material being discharged to CS-A before 1950. Staining is evident in photographs of CS-A since that time. Presently, only surface and roof drainage from the Cerro Copper Products Company plant is discharged into CS-A. Water in CS-A is currently directed to an interceptor at the north end of the Cerro property, and is eventually discharged to the Sauget Waste Water Treatment Plant. Water in CS-A is currently extremely discolored and oily, and dark staining is evident along the entire length of the creek bank. Flow from CS-A to the south is restricted by a blocked culvert under Queeny Avenue." (E&E Report; Pg. 7-3)

Geology and Soils

"The upper 14 to 50 feet of the unconsolidated valley fill deposits found in the American Bottoms were investigated during the Sauget Sites Area study. The valley fill deposits are typically composed of two main formations which extend as deep as 120 feet in the Sauget Sites Area."

"The Cahokia Alluvium is the uppermost formation and comprises thin, generally discontinuous beds of silt, clay, and silty sand. In study area soil borings, an average of 13 to 20 feet of sandy silt and clay deposits was found overlying silty sands, which gradually grade into a fine- to medium-grained clean sand in lower portions of the formation."
(E&E Report; Pg.7-9)

"Underlying the alluvium is the Mackinaw member of the Henry Formation. The upper portion of the Henry Formation consists of light brown to gray fine- to coarse-grained sand which coarsens with depth. The literature indicates that bands of coarse gravel, cobbles, and occasional boulders are found at depths greater than 75 feet. These sand and gravel deposits directly overlie the Mississippian Age St. Genevieve Limestone."

Geology of Soils - Creek Sector A

"Sediment samples from both the northern and southern segments of CS-A consisted predominantly of sandy silt, suggesting that the creek bottom may be heavily silted along its entire length." (E&E Report; Pg. 7-12)

Groundwater Hydrology

The research performed indicates that groundwater exists in both the Cahokia Alluvium and Henry Formation valley fill materials under hydrostatic pressure and leaky artesian conditions.

The Cahokia and Henry formations should be classified as a single hydrogeologic unit due to; 1) the hydrologic relationship which exists between the units; and 2) the lack of continuous confining layers between or within the individual units.

E&E simplified the hydrogeology by dividing the aquifer system into three zones based on hydraulic conductivity. The three zones are:

1) The Shallow Zone - a relatively lower conductivity zone consisting of the alluvial silty sand and fine-grained sand deposits found in the lower portions of the Cahokia Unit and the upper portions of the Henry Formation. This zone extends from the water table to a depth of approximately 45 feet below the surface;

2) The Intermediate Zone - this zone includes the medium to coarse valley fill sand and gravel of the Henry Formation which is encountered from 45 to 75 feet below the surface. It is considerably more permeable than the shallow zone; and

3) The Deep Zone - this zone includes the coarsest, most permeable portions of the Henry Formation which rests directly on top of the limestone bedrock. The deep zone extends from 75 feet to approximately 110 to 120 feet below the surface.
(E&E Report; Pg. 7-17)

Current Groundwater Flow - Area 1

"Based on water level measurements at Site I, it was concluded that water in CS-A is not heavily influenced by groundwater, but appears to be the result of storm runoff and drainage from the Cerro plant. This water is perched, due to the heavily silted creek bed above the water table."
(E&E Report Pg. 7-19)

Chemical Results/Surface Water and Sediments

The analytical results of the surface water and sediment sampling revealed contamination in CS-A. Volatile organic contaminants were detected in two samples collected from CS-A. Eight volatile compounds were detected within the two samples, with the highest concentration being 0.041 mg/l of 1,1,1-trichloroethane. The semi-volatile organic compound, 4-chloroaniline, was also detected in CS-A at a concentration of 0.003 mg/l.

Elevated concentrations of several heavy metals were detected in surface water samples collected from CS-A. Cadmium, mercury, copper, barium, arsenic, chromium, and lead were all detected. (E&E; Pg. 7-22&23)

3.1.2 Conclusions

"The analytical data from sediment sampling, the physical evidence of stained soils, discolored and oily water, and the presence of effluent pipe outlets in CS-A indicate that the contamination found in CS-A resulted from several sources. Organic contaminants detected in sediment samples from CS-A included chlorobenzene, pentachlorophenol, dichlorobenzenes, PAHs, and PCBs. Additionally, IEPA and Illinois Attorney General's Office file information contain several reports of past direct discharge of process water and wastes from the Monsanto Krummrich Plant to Dead Creek. Historical aerial photographs show staining in CS-A resulted, at least in part, from direct discharge of waste materials from Monsanto."

"Although rough [sic] drainage and surface runoff from the Cerro property are the only known continuing discharges to CS-A, the extreme discoloration and oily consistency of the water in CS-A suggests the existence of an ongoing unidentified source. The elevated concentrations of heavy metals, including copper, lead, and chromium, detected in surface water samples from CS-A support the supposition that discharges from the Cerro property have contributed to the contamination in CS-A."
(E&E Report; Page 7-41)

3.2 Work Performed by The Avendt Group, Inc.

3.2.1 Objectives

The Avendt Group, Inc., was retained by Lowenstein, Sandler, Kohl, Fisher & Boylan to perform a Site Investigation and Remedial Alternatives Evaluation at Creek Segment A, located in Sauget, St. Clair County, Illinois. The Site Investigation portion of the study was being performed to fully evaluate CS-A. The information gathered through this portion of the project was utilized to evaluate alternatives for the remediation of CS-A. Field activities designed to characterize CS-A began July 5, 1989, and continued through July 21, 1989.

3.2.2 Health and Safety Considerations

The Health and Safety Plan for the CS-A project is contained in Appendix A of this report.

3.2.3 Sampling Rationale

In order to properly delineate and characterize CS-A, a systematic sampling scheme was devised. CS-A was divided into ten transverses oriented in an east-west direction. Locations of the transverses are shown in Plate 2 and described below:

A16 - 1050 feet from the south end of CS-A1.
A15 - 850 feet from the south end of CS-A1.
A14 - 650 feet from the south end of CS-A1.
A13 - 450 feet from the south end of CS-A1.
A12 - 250 feet from the south end of CS-A1.
A11 - 50 feet from the south end of CS-A1.
A10 - South Edge of Cerro Plant Road (Old Queeny Avenue)
A21 - 100 feet from the north end of CS-A2.
A22 - 100 feet from the south end of CS-A2.
A23 - 450 feet from the north end of CS-A2.

The sediment/soil borings were identified by letter from west to east. Creek transverses A11, A12, A13, A14, A15, and A22 contain four sediment/soil borings. The borings located on the east and west banks of the creek are approximately five feet from the edge of the creek. Two borings per transverse were performed within the creek channel. These borings were located five feet from the west and east creek banks, respectively.

Transverse A21 contained three (3) sediment/soil borings. These borings were also identified by a letter from west to east. The borings were performed as previously discussed, except one boring location was eliminated due to confined space and overhead power lines (Plate 2).

Transverse A16 contained five sediment/soil borings. As with the other borings, this was identified by a letter from west to east. The borings were performed as previously discussed except one additional boring was performed 20 feet east of the creek bank along this transverse (Plate 2). The additional borings were necessary because of the larger area at the north end of CS-A1.

Two boring methods were employed for the characterization of sediments/soils in CS-A. Characterization of bottom sediments, when working within the creek channel, were accomplished with a small drilling rig, utilizing five foot long hollow stem augers. The drilling rig was mounted on a 28 foot long, eight foot wide reinforced aluminum pontoon. The pontoon was anchored to the creek channel bank with cables and metal stakes.

Boring operations on the creek banks were performed with an all-terrain vehicle (ATV) drilling rig utilizing five foot long hollow stem augers.

The five foot long hollow stem augers produced a six-inch outer diameter borehole. The inner diameter of the hollow stem auger is 4-1/4 inches. During core classification and sampling, the hollow stem augers were decontaminated with a hand-held, high-pressure steam cleaner.

A continuous core sample was collected for each boring. The core sample was collected by utilizing a 4-1/4 inch diameter, five foot long continuous split spoon sampler. The sampler was advanced into the sediments approximately two to four inches ahead of the auger flights. The continuous core sampler was decontaminated between each boring with Alconox detergent and a steam-cleaning rinse.

All boreholes were plugged after making strata observations and sediment/soil sample collection. The shallow boreholes were plugged with "Holeplug" 100% granular bentonite. When bridging occurred, identified by breakthrough when tamping the holeplug pellets, a bentonite slurry was trimmied into the borehole. The borehole was filled to within one foot of the ground surface. The remaining foot or so was filled with clean soil.

The depth of each borehole varied according to the location of the boring within the creek section. Sediment borings were advanced to the Dead Creek sediment/Mississippi River flood plain strata interface, and included the upper few inches of the Mississippi River flood plain sediments.

The borehole cores were logged by AGI personnel. Bottom sediments were described in accordance with the Unified Soil Classification System. The borehole log information included:

- Boring number
- Project number
- Site Location
- Time
    - Beginning
    - End
- Total Depth (feet)
- Hole Diameter (inches)
- Type of Sampling/Coring Device
- Length and Diameter of Coring Device
- Sampling Interval
- Boring Method
- Boring Contractor
- Driller
- Hammer Weight and Drop (if applicable)

In addition to the items outlined above, all related observations about boring rate, equipment operation or unusual conditions were noted.

This information included:

- Rig reactions such as chatter, auger drops, and bouncing;
- Boring rate changes
- Material changes
- Grouting material (if necessary)

All boring equipment (i.e. augers. drilling rods. etc.) was steam-cleaned between borings. Avendt Group personnel observed the steam-cleaning operations to maintain quality assurance/quality control (QA/QC) (Appendix B). All dirt and material was removed from the auger flights. The five-foot continuous core sampler was decontaminated with Alconox detergent and rinsed with deionized water.

3.2.4 Geotechnical Characterization

3.2.4.1 Description of Sediment Sampling Events

CS-A was characterized by collecting 99 samples through a network of 34 sediment-soil borings distributed on ten east-west transverses across CS-A1 and CS-A2 (Plate 2). The borings were performed using two drilling methods; 1) the borings inside the creek channel were performed using a pontoon-mounted drilling rig utilizing five-foot long hollow stem augers, and 2) the borings performed on the creek banks were performed using an ATV drilling rig utilizing five-foot long hollow stem augers. The samples were collected using either a three-inch diameter, five-foot long continuous core sampler, or a three-inch diameter, 18-inch long split spoon sampler. Samples were collected at three depth intervals: shallow, intermediate, and deep, and/or at sediment/soil interfaces.

Strict quality assurance/quality control procedures were established in the Quality Assurance Project Plan (QAPP). The Qapp is included in Appendix B of this document. All drilling and sampling equipment were steam-cleaned prior to moving to the next boring location. Water from steam cleaning was allowed to drain back into the creek. All sample jars were sealed and stored in coolers prior to use. Once the cooler seal was broken, the sample jars were not left unattended until the cooler was sealed prior to shipment to the laboratory.

Two planned boring locations were eliminated due to overhead power lines and trees; however, two additional borings were performed, borings A10B and A23C (Plate 2).

3.2.4.2 Physical Description of Lithologies Encountered in Boreholes

The site investigation performed at the CS-A site disclosed a generalized stratigraphic cross section which consists of four identifiable stratigraphic units; 1) fill material, 2) fluidized creek bottom sediments, 3) the Cahokia Unit, and 4) the Henry Formation (Figure 2). However, in isolated instances, a thin clay layer was encountered. Boring logs were kept in the field during drilling operations (Appendix C). The unit descriptions are as follows:

Fill Material

Tan to black, stained, dry, sandy silt to silty sand, intermixed with concrete, bricks, road aggregate, rags, slag, and vitreous pellets. It was often characterized by a chemical odor. The fill material varied from one to 15 feet thick depending on the location along the creek bank (Figure 3).

Fluidized Creek Bottom Sediments

Brown to yellowish brown, black, mottled, wet, fluidized silt. Contained organic matter and exhibited a chemical odor. The fluidized creek sediments ranged from one-half to 11 feet thick (Figure 4).

Generalized Stratigraphic Units

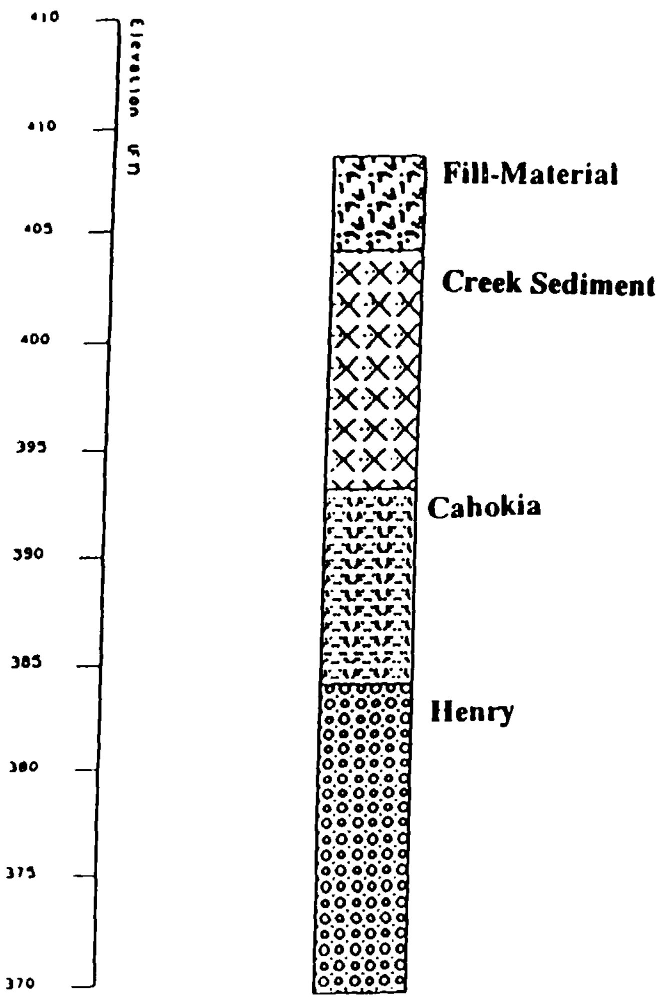
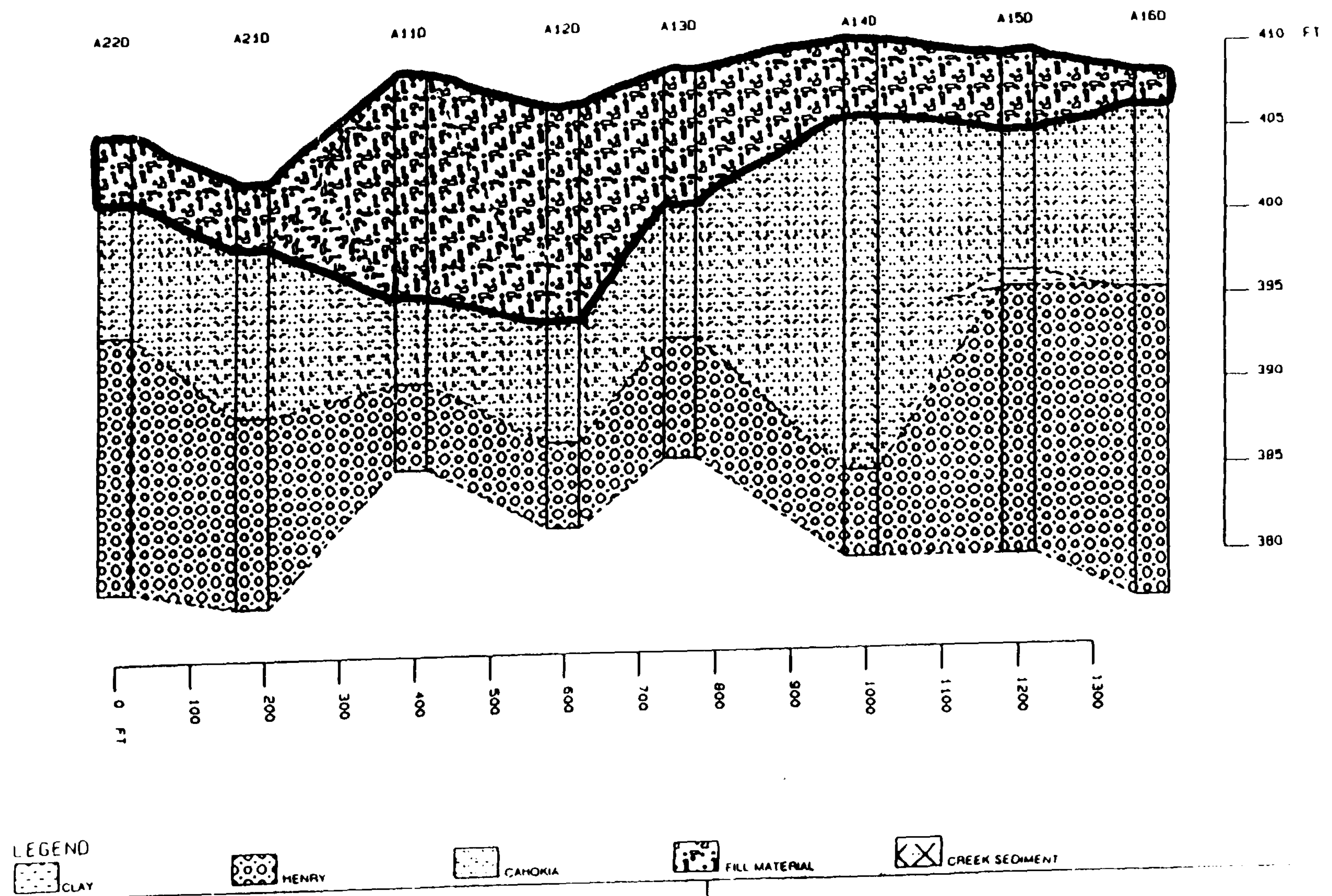


Figure 2
Generalized stratigraphic cross section of the units encountered during drilling operations at the CS - A



CS - A
Borehole Cross Sections

Figure 3

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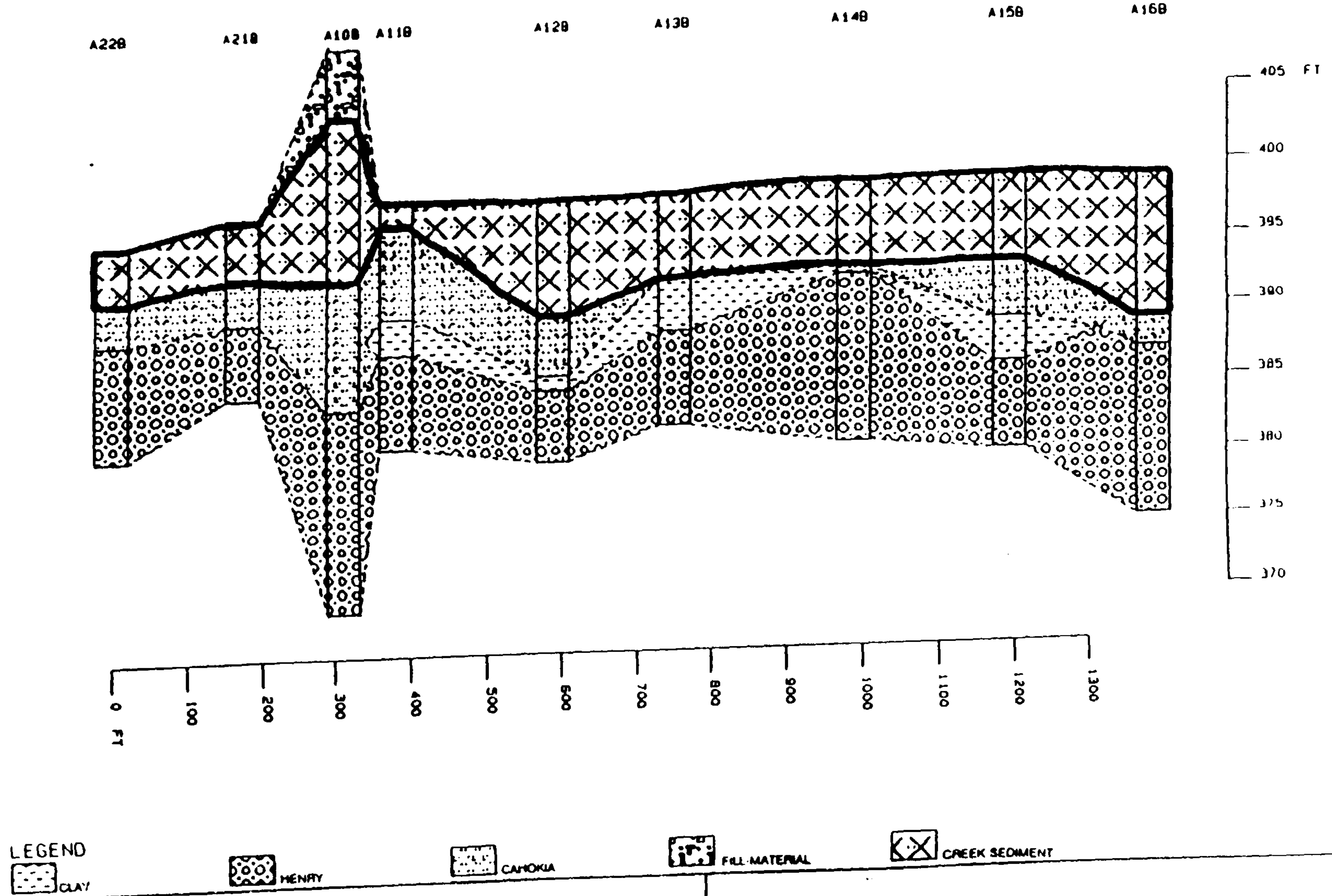

CS - A
Borehole Cross Sections

Figure 4

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The Cahokia Unit

Light brown, tan to black, dry to moist clayey silt to silty clay. The lower portion of the unit was frequently gray in color. The unit was moderately plastic and contained minor amounts of organic matter. This unit also contained a chemical odor. This unit also exhibited a moderately continuous, thin clay lens which pinches in and out along the entire length of the creek. This clay seam ranging from one-half inch to three feet in thickness. The Cahokia unit ranges from one to 20 feet thick (Figure 5).

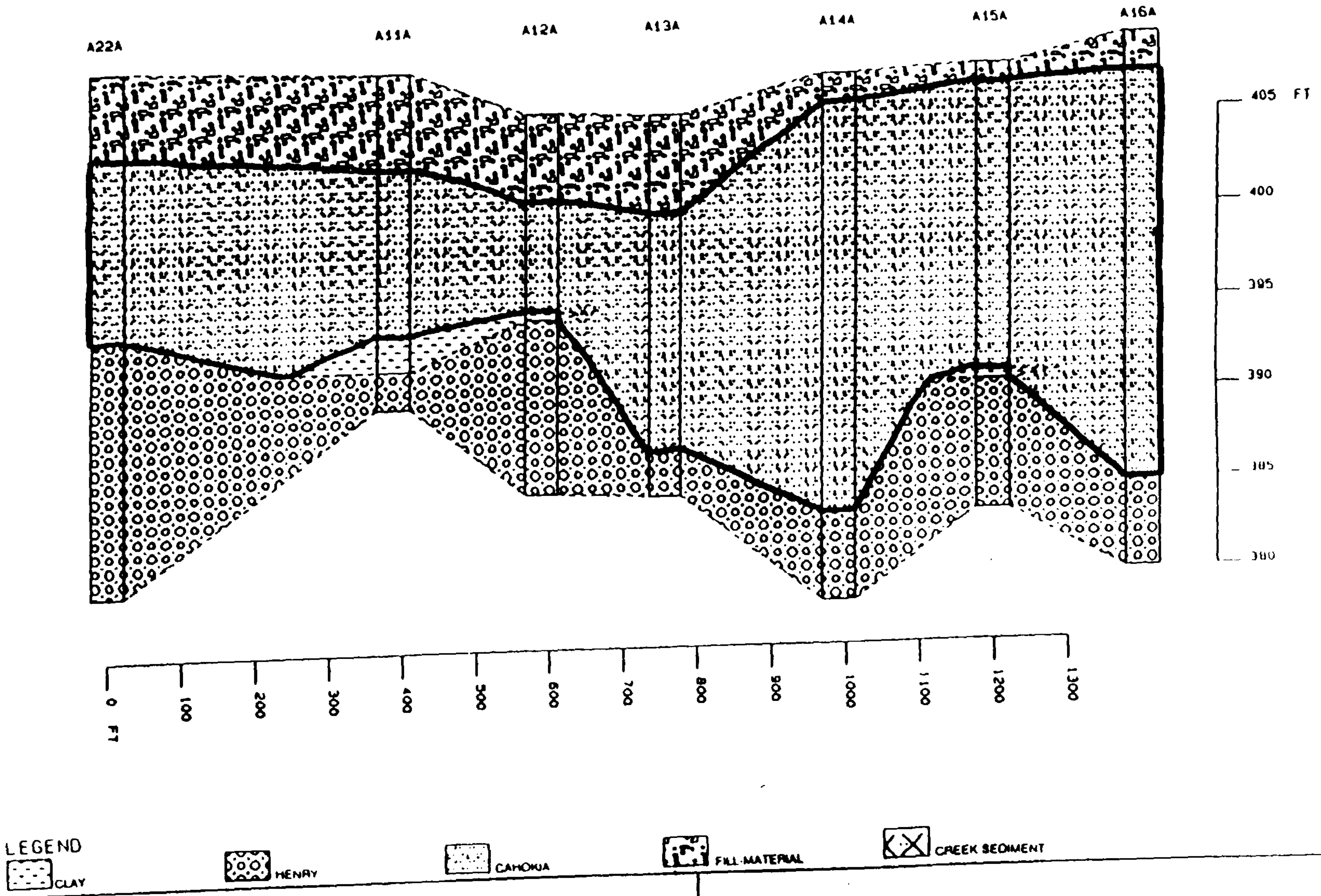
The Henry Formation

Gray to greenish gray, moist to wet silty sand to medium sand. Quartz grains were easily identified without a hand lens. Small black specks were intermixed throughout the unit. Thin clay lenses were frequently found within the upper portions of the unit. The bottom of the Henry Formation was not determined; however, review of the literature indicates that the Henry extends to bedrock which is 110 feet below the land surface (Figure 6). This unit also exhibited a chemical odor.

3.2.5 Criteria Utilized in Determining Extent of Contamination

In order to define the limits of the fluidized creek bottom sediments, boring samples were visually inspected by a geologist during drilling operations. The fluidized creek sediments were readily distinguished from the underlying soils by visual indicators of the differing soil types indigenous to the area, as explained in Section 3.2.4.2.

No fluidized sediments were found beyond the limits of the creek.



CS - A
Borehole Cross Sections

Figure 5

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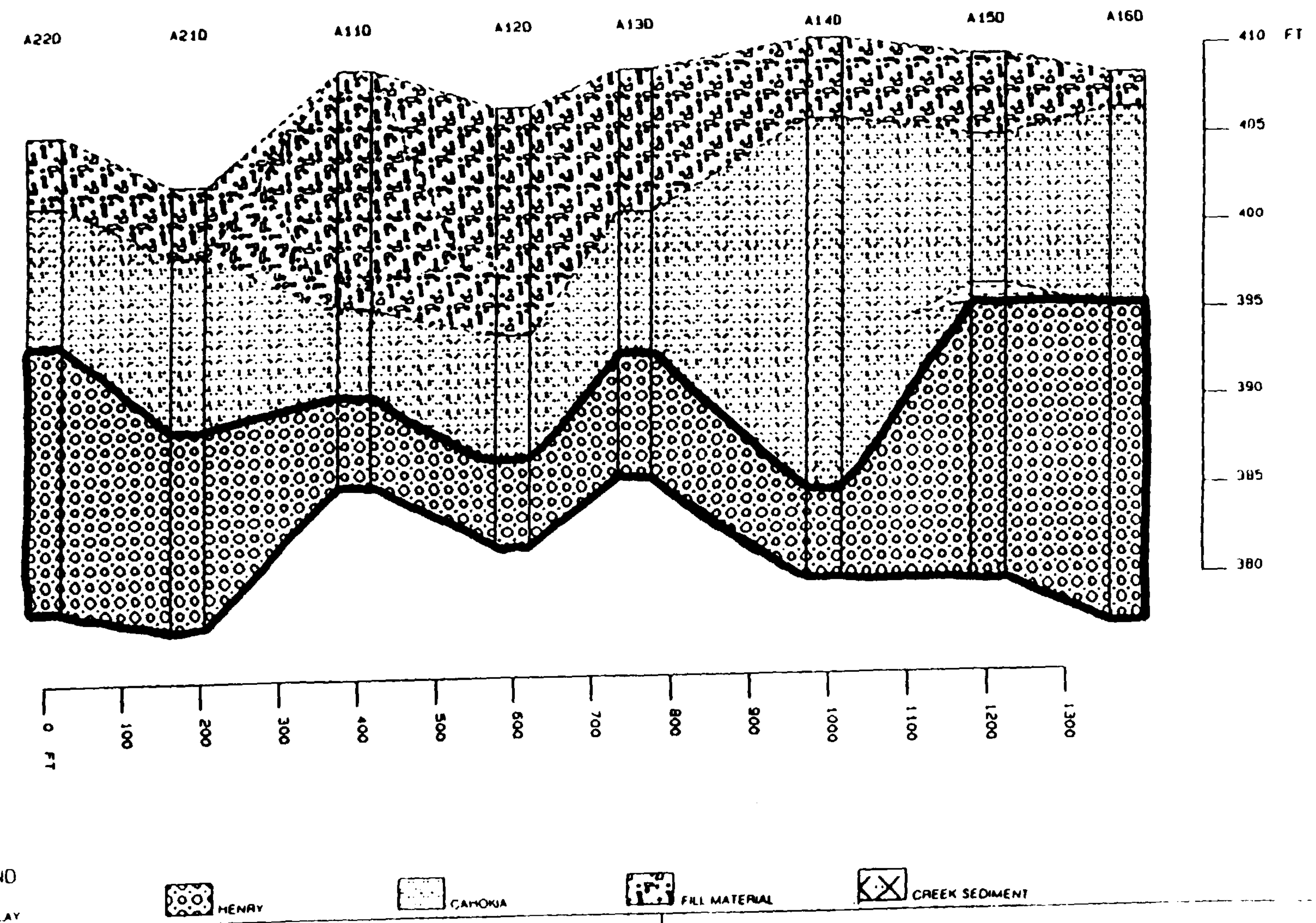

CS - A
Borehole Cross Sections

Figure 6

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3.2.6 Transverse/Zone Diagram

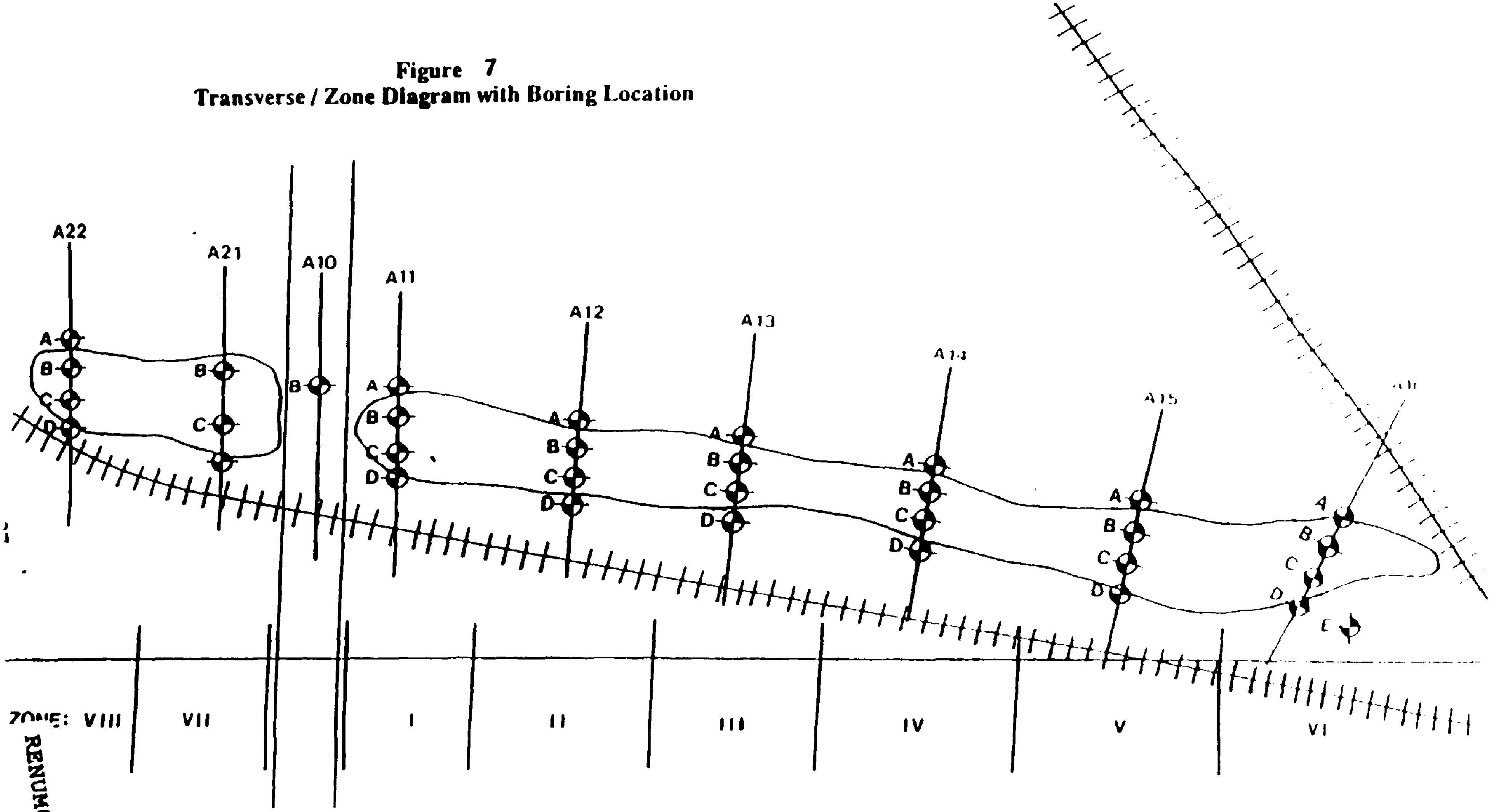
See figure on the following page

3.2.6

TRANSVERSE / ZONE DIAGRAM

(Indicate A,B,C,D Series on Map)

Figure 7
Transverse / Zone Diagram with Boring Location



3.2.7 Boring Log Data and Explanation

Boring logs were compiled during each boring performed at the CS-A site. The boring logs were documented by a qualified geologist of AGI (Appendix C).

The data generated through the documentation of each boring indicated that the stratigraphy at the CS-A site consisted of four unconsolidated units (Figures 8-17). These units were described in the previous section 3.2.4.2. The stratigraphy was characterized to determine unit thickness, unit contacts and sample depth intervals.

Figure 8
CS - A
Boring Logs

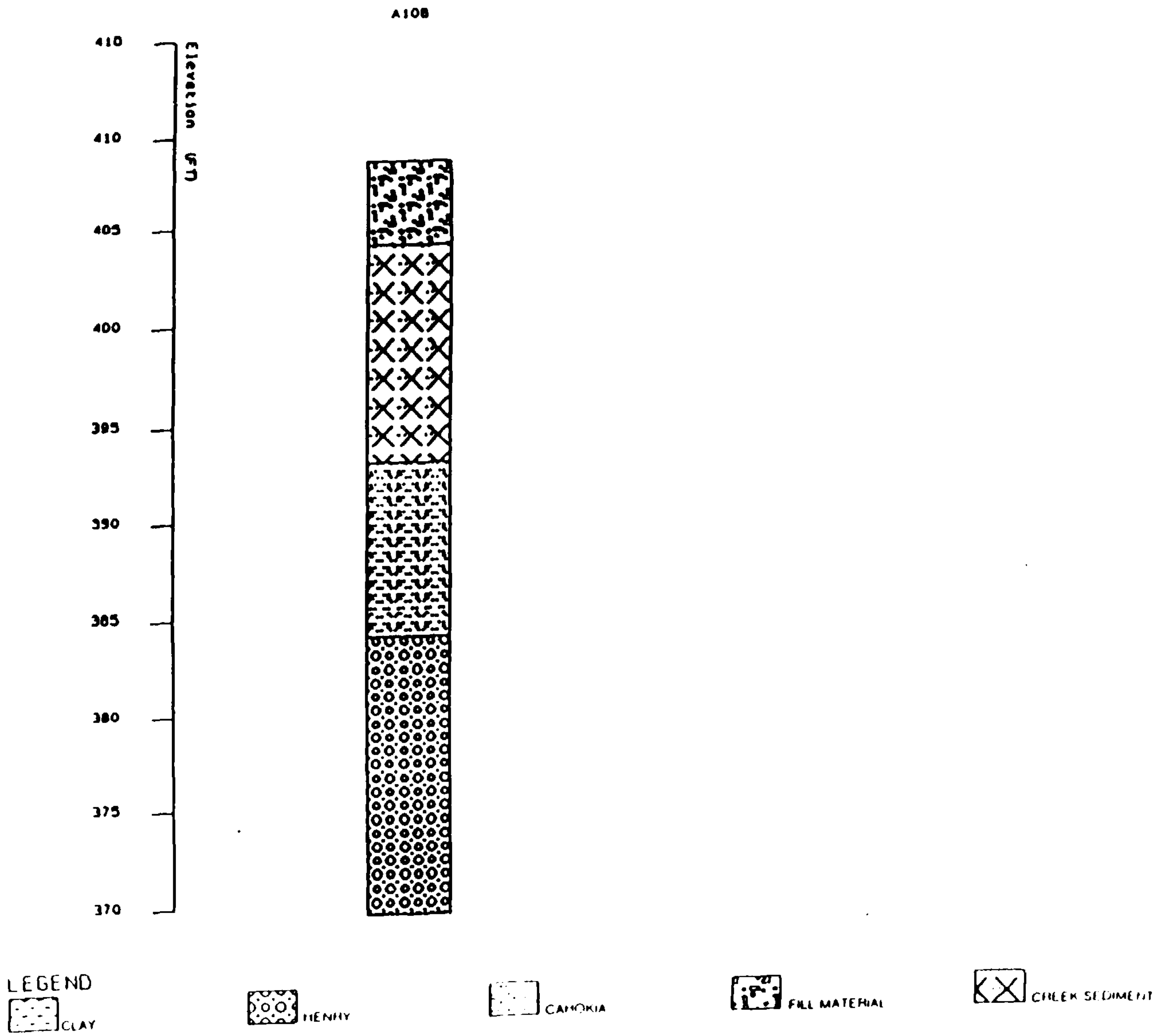


Figure 9
CS - A
Boring Logs

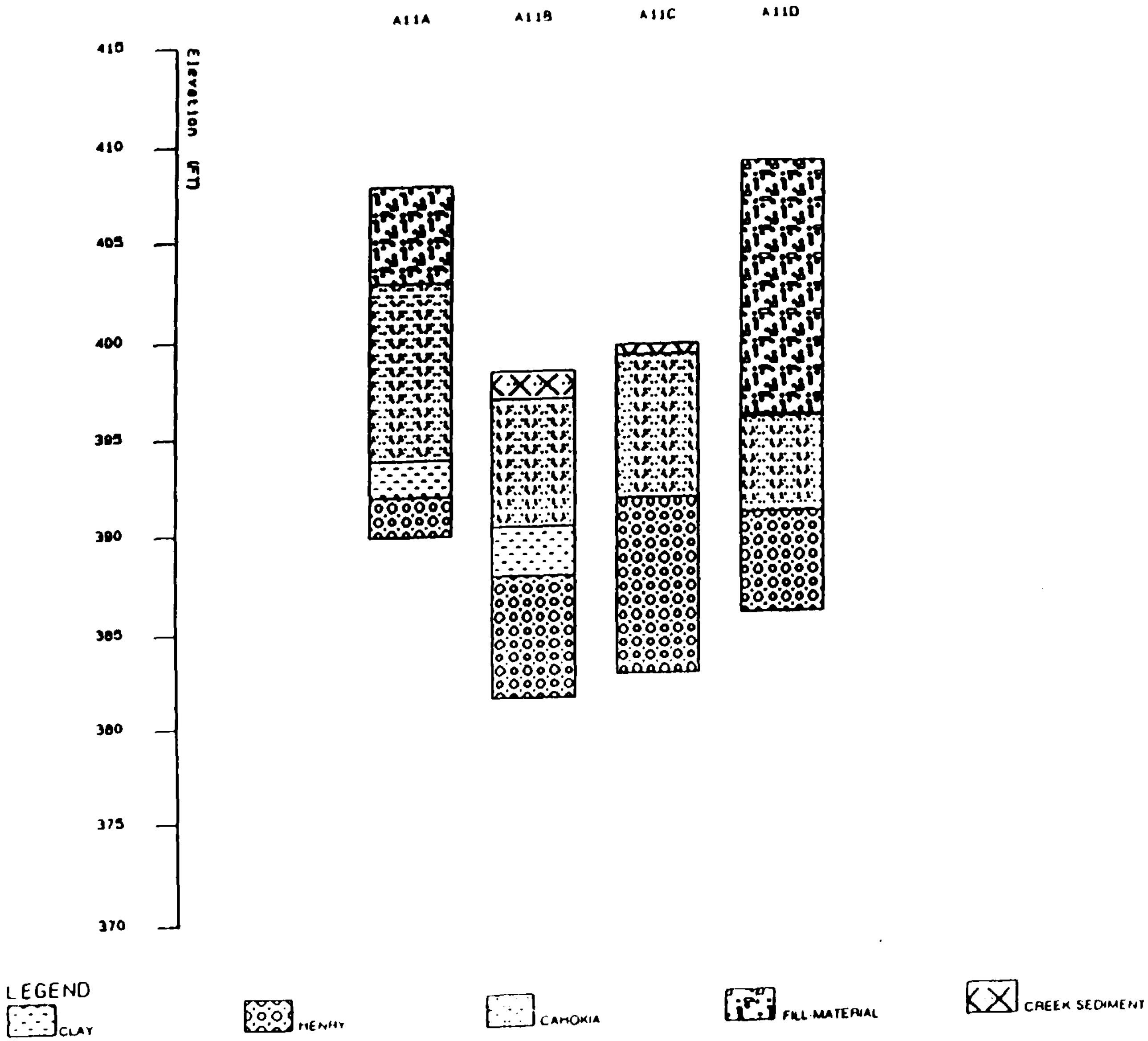


Figure 10

CS - A
Boring Logs

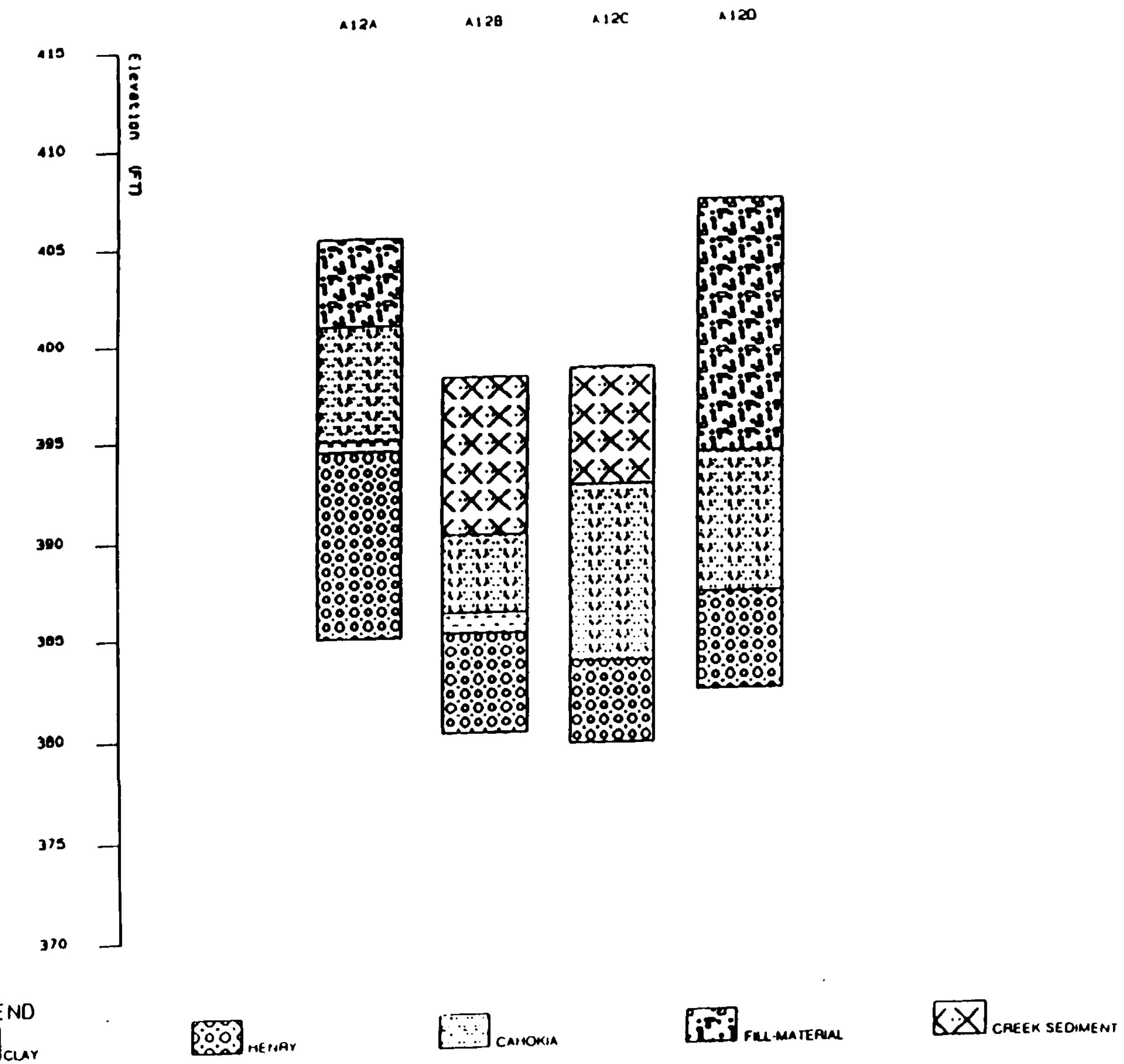


Figure 11
CS - A
Boring Logs

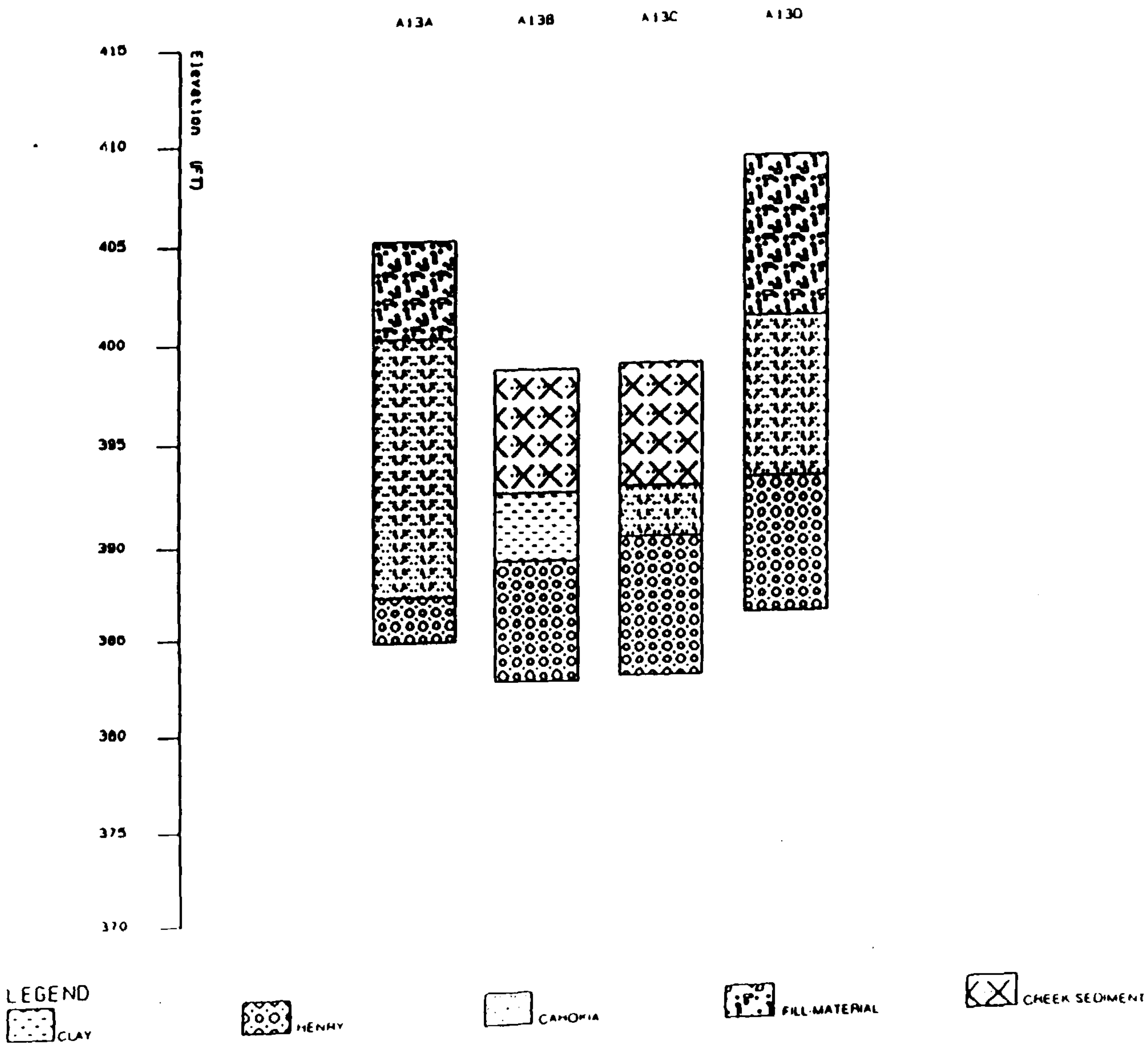


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Figure 12
CS - A
Boring Logs

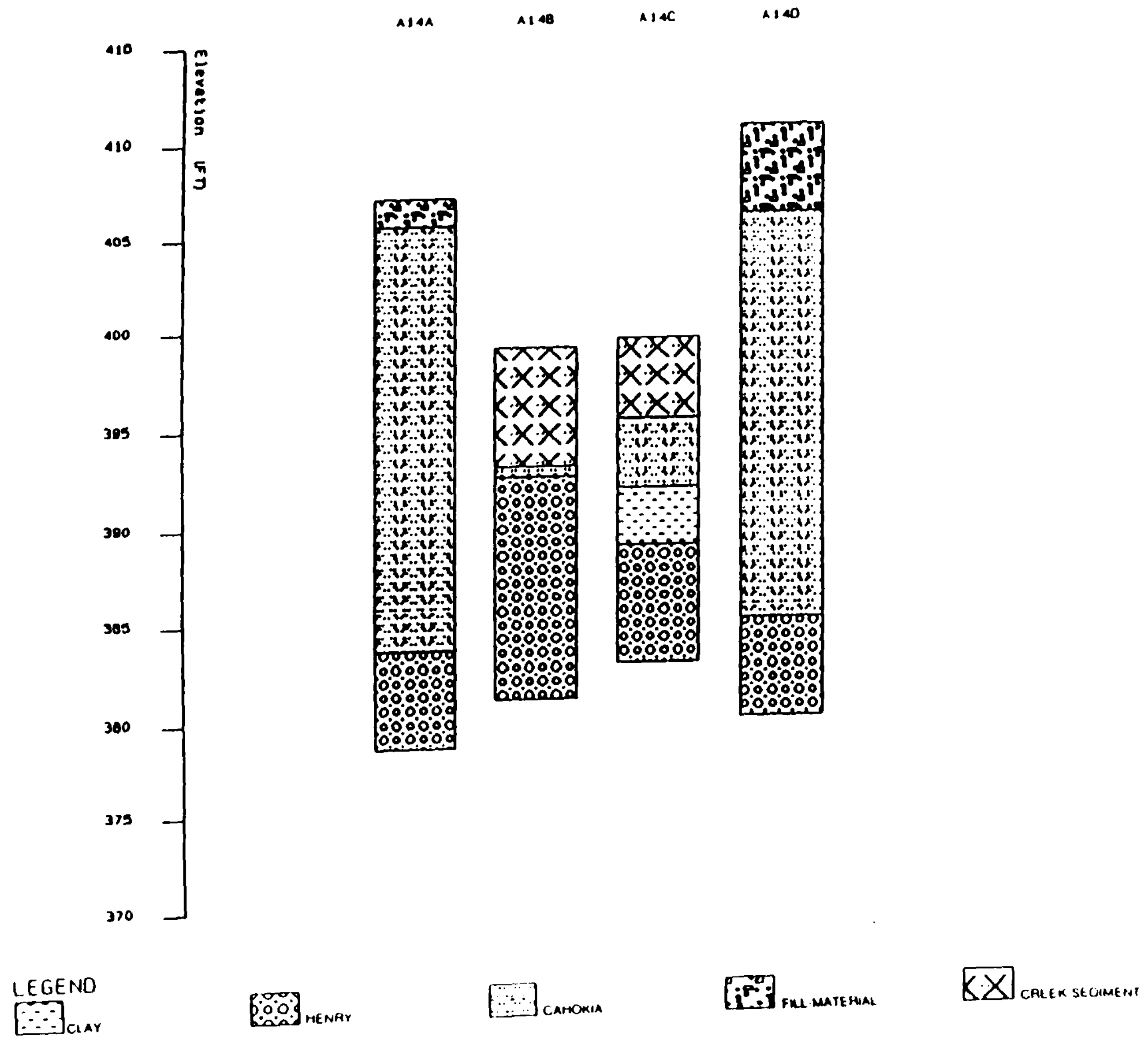
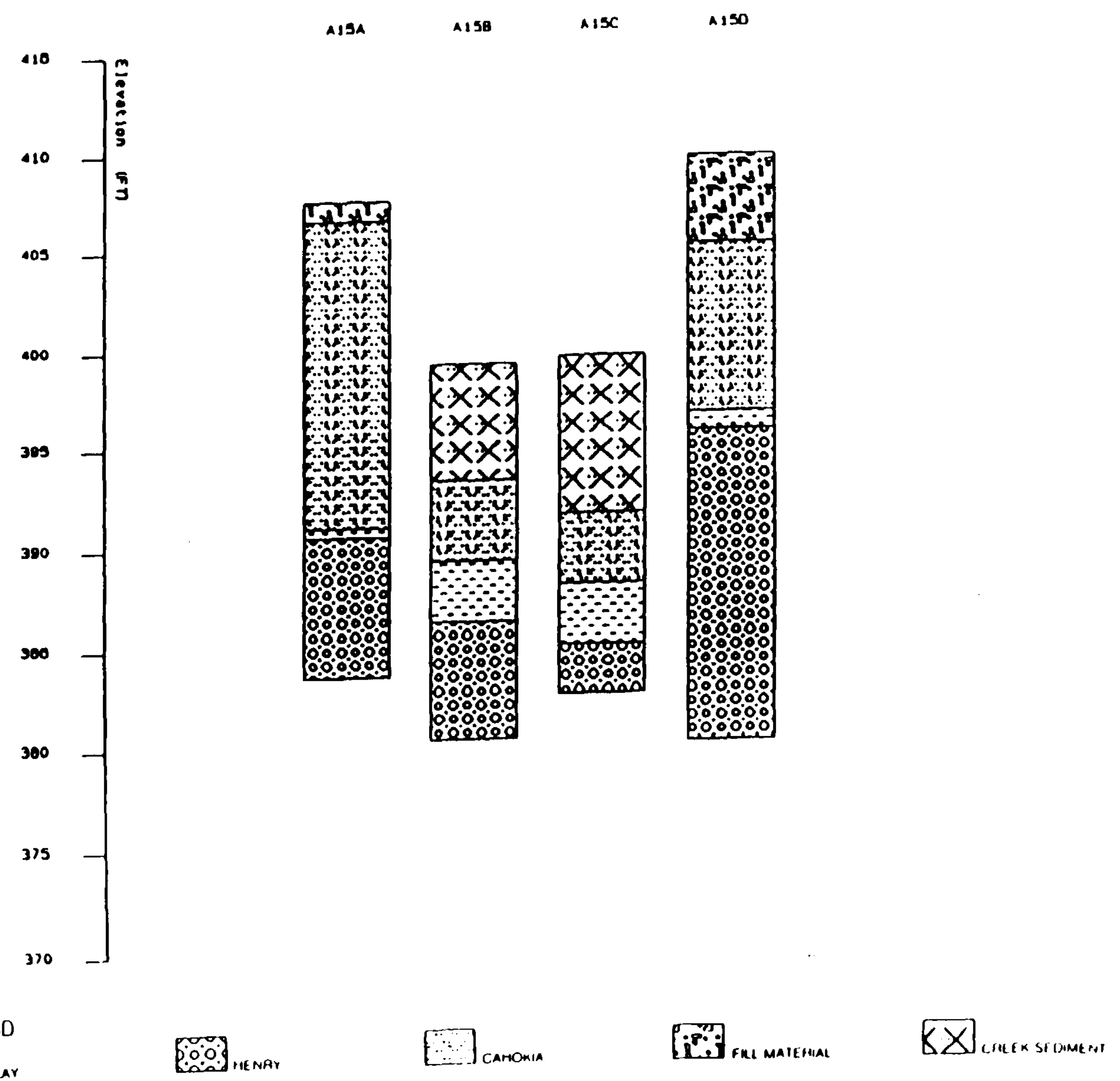


Figure 13
CS - A
Boring Logs



RENUM001762

Figure 14
CS - A
Boring Logs

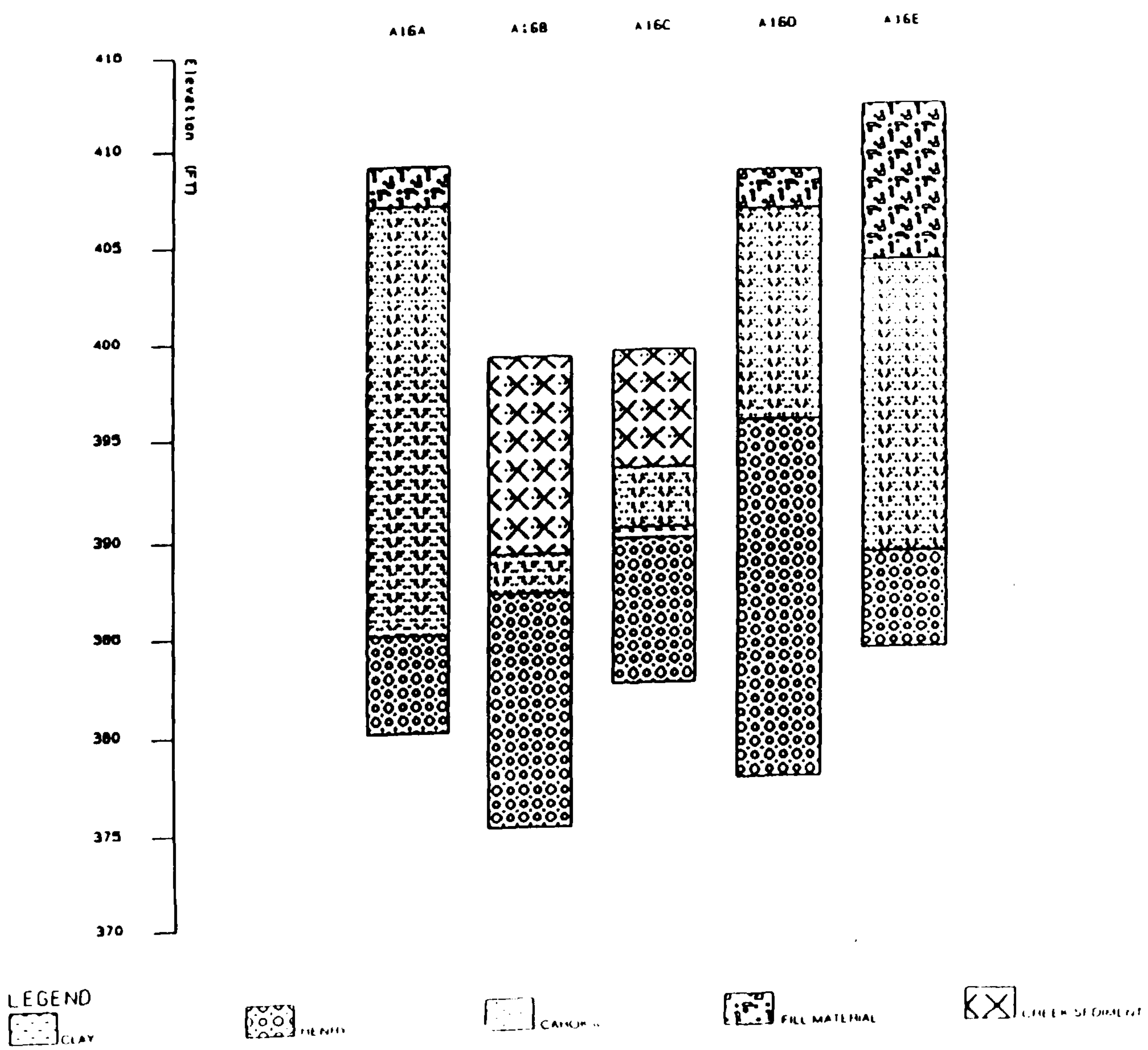


Figure 15

CS - A
Boring Logs

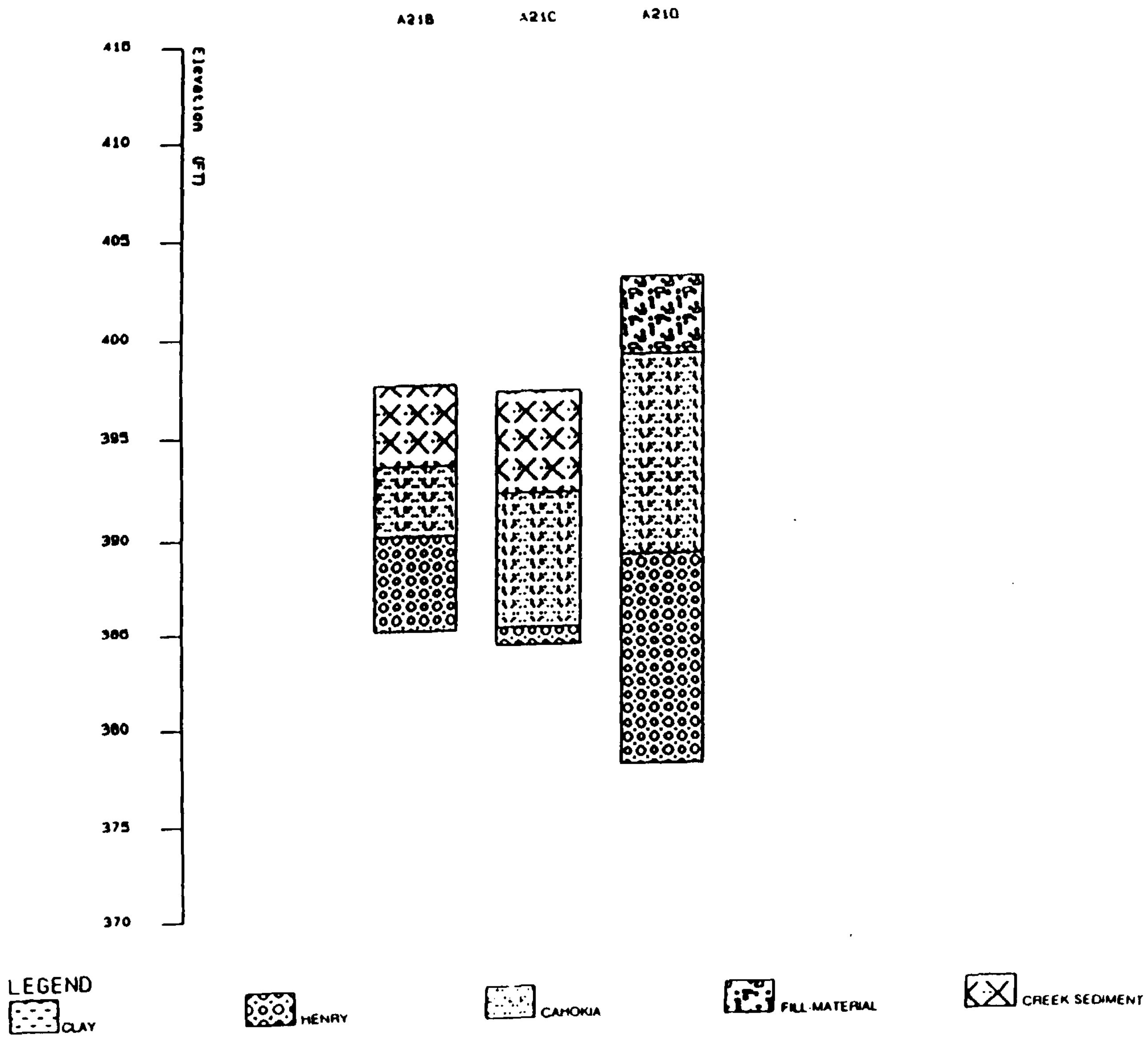


Figure 16
CS - A
Boring Logs

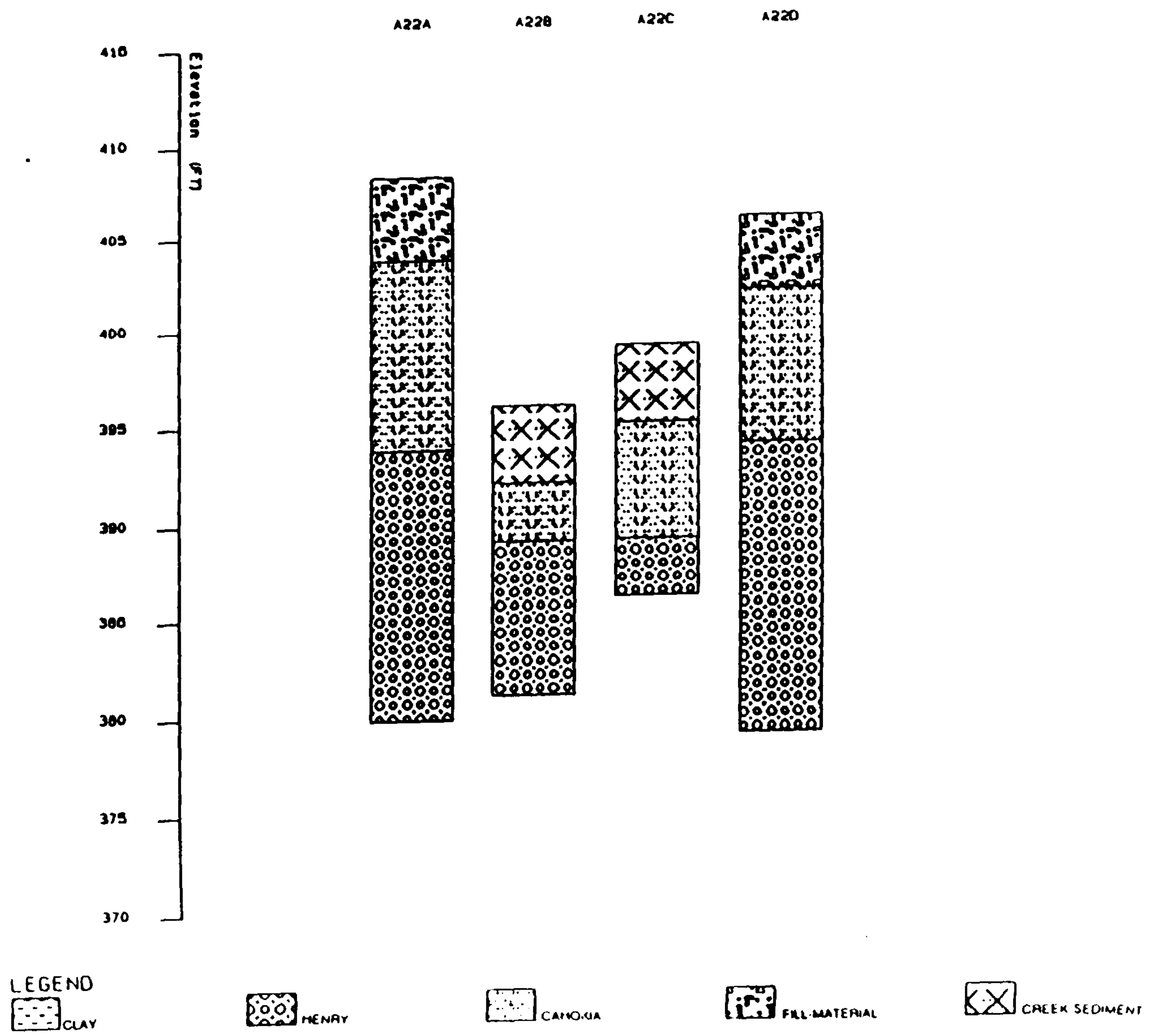
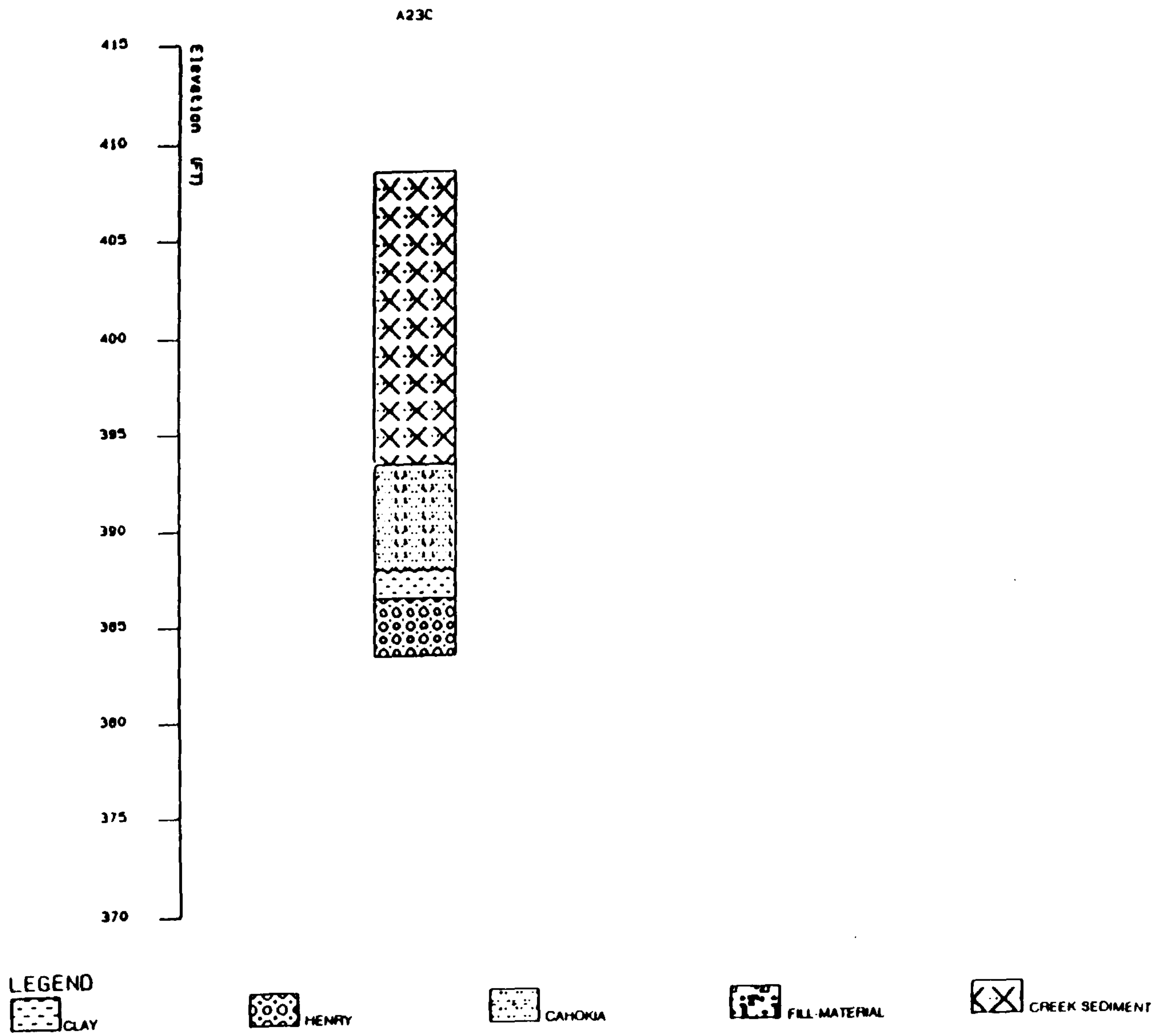


Figure 17

CS - A
Boring Logs



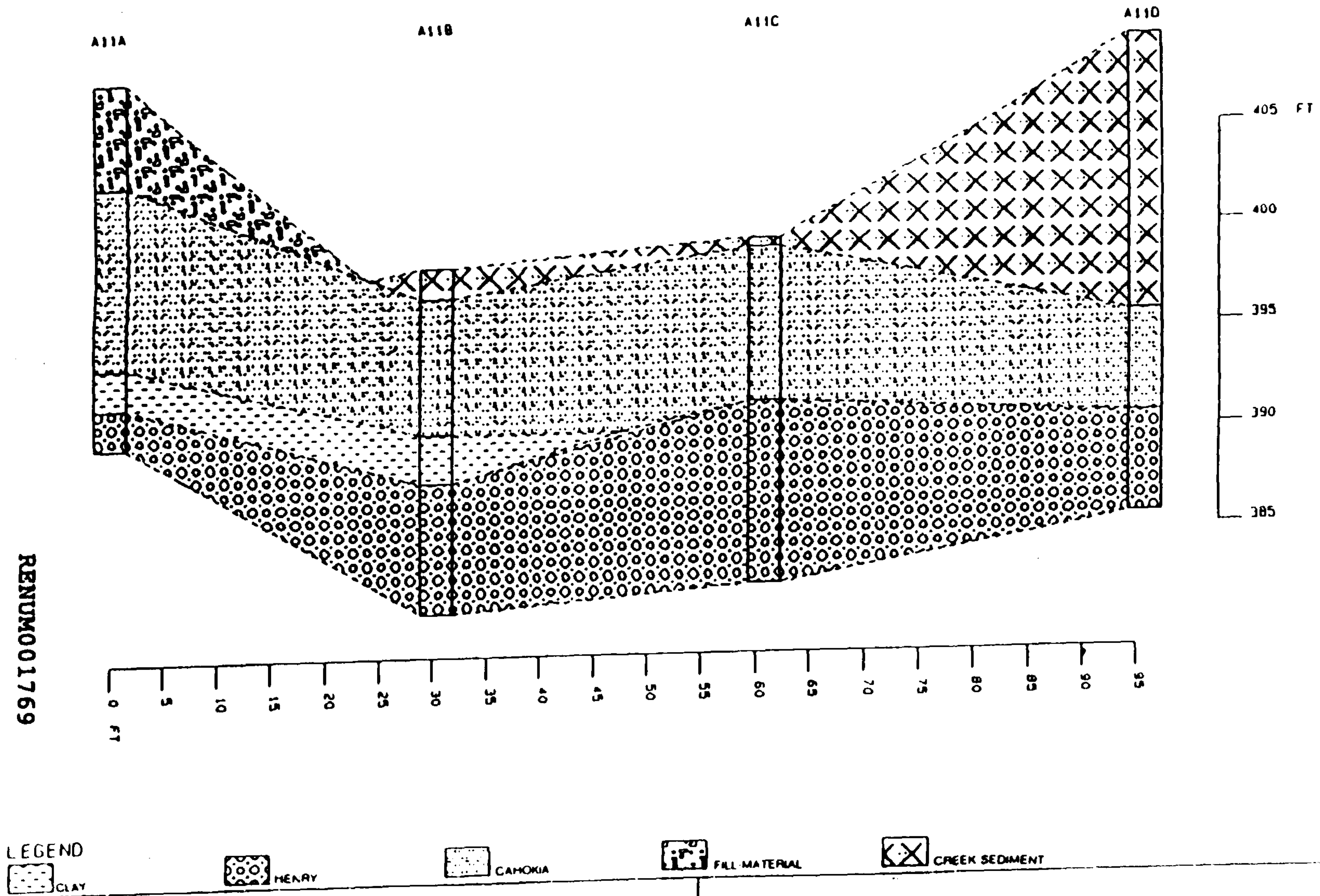
RENUM001766

3.2.7.1 Transverse Sections

See figures on the following pages.

3.2.7.1
TRANSVERSE SECTIONS

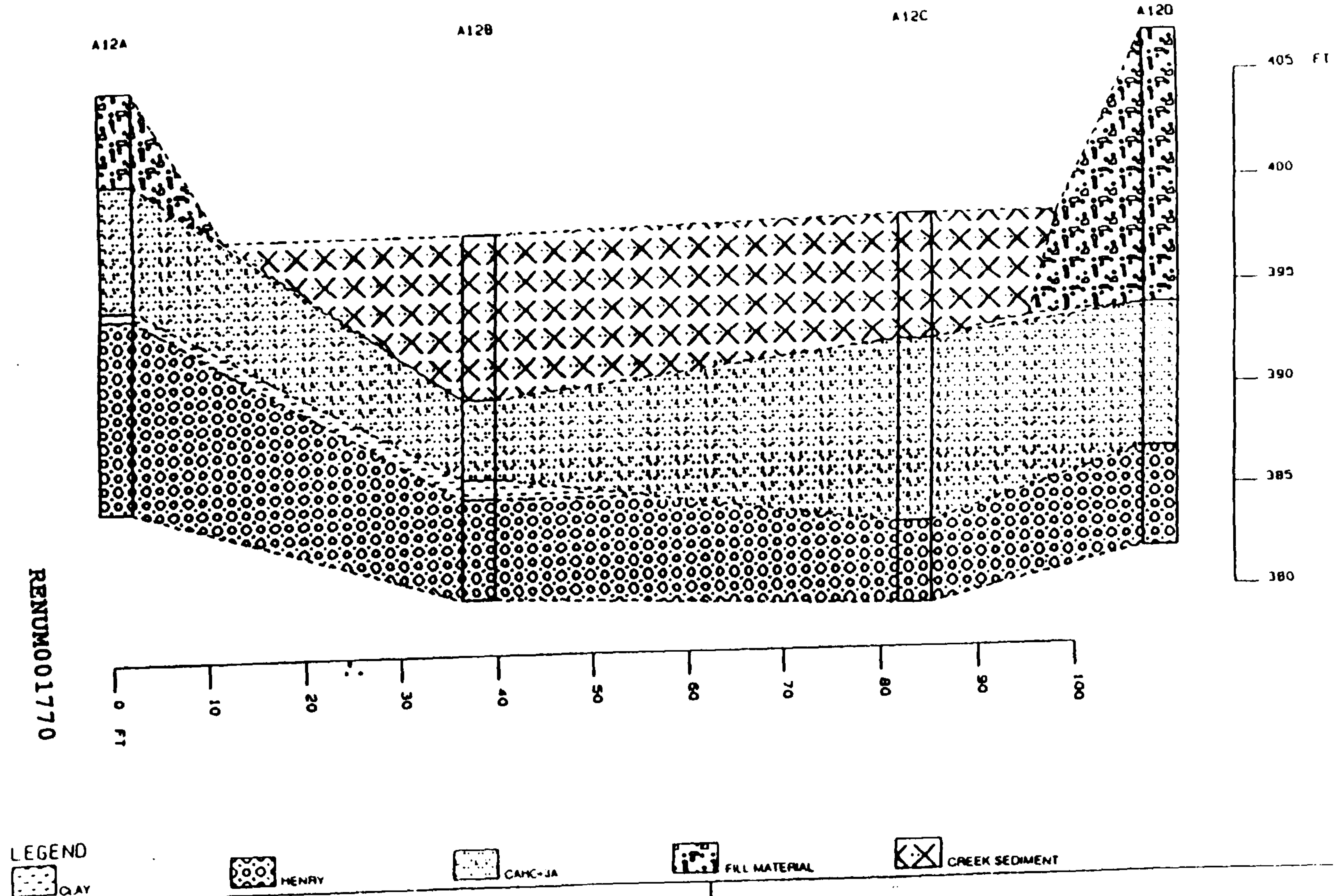
RENUM001768



CS - A
Transverse Cross Section

Figure 18

THE AVENDT GROUP, INC

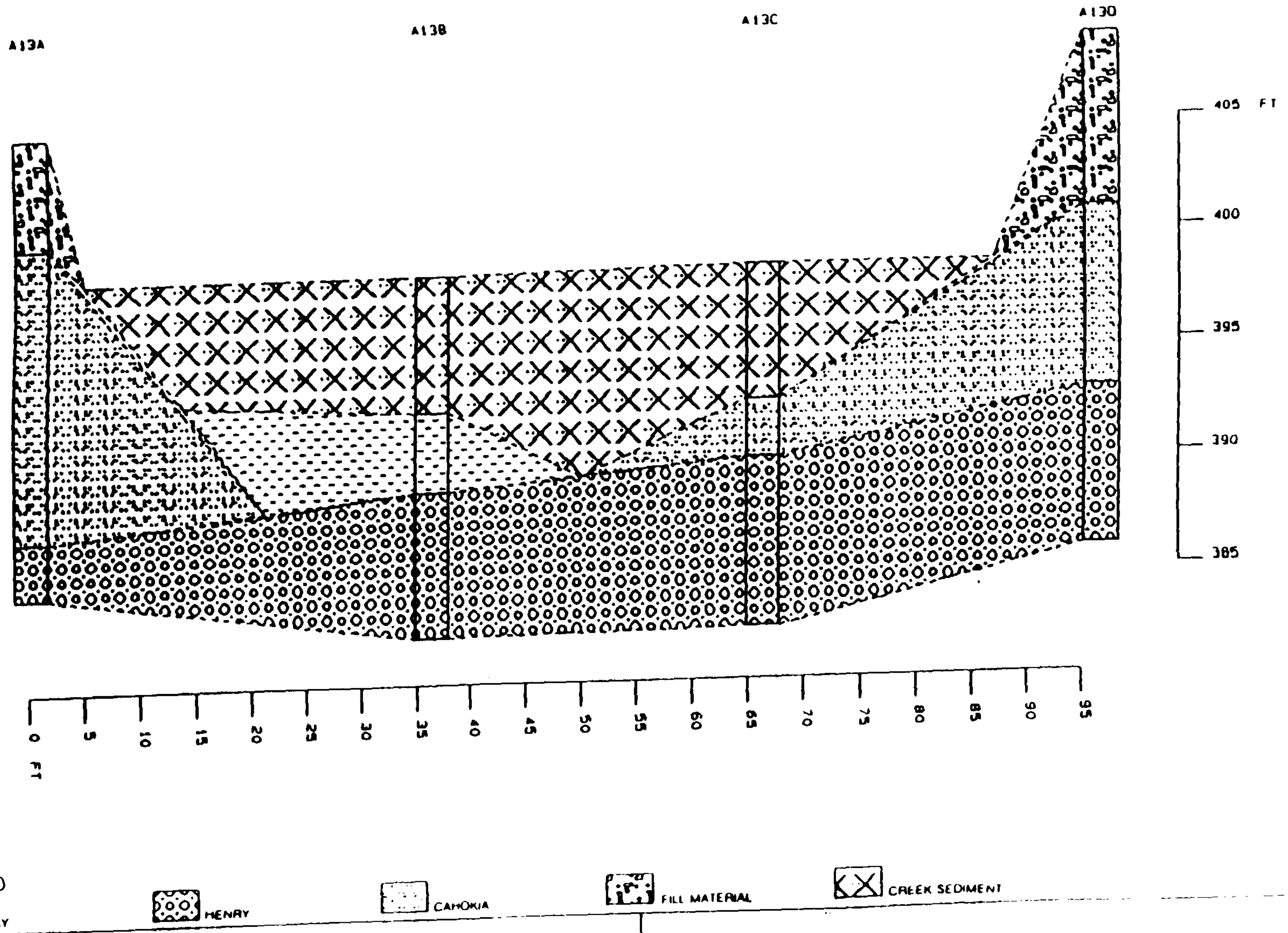


RENUM001770

CS - A
Transverse Cross Section

Figure 19

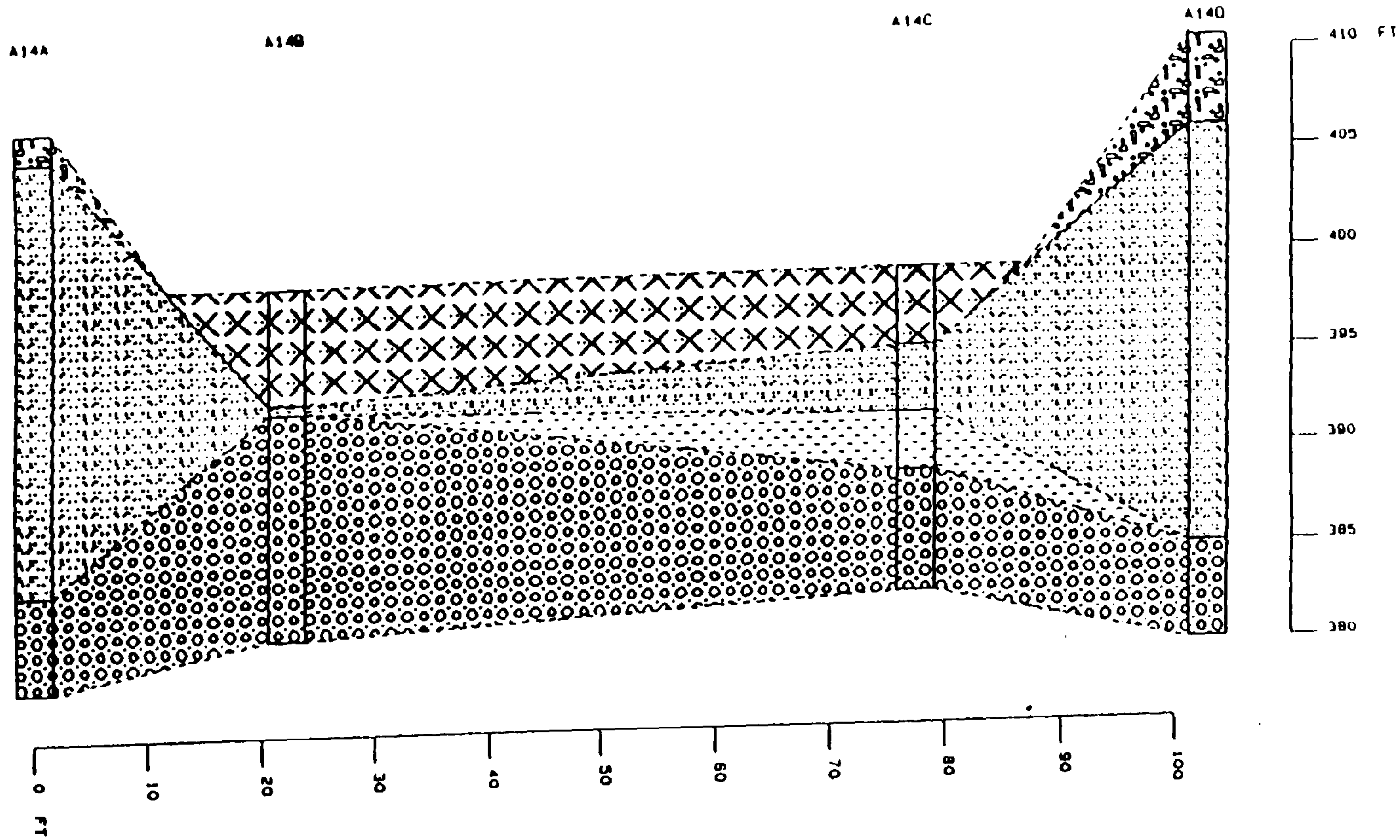
THE AVENDT GROUP, INC.



CS - A
Transverse Cross Section

Figure 20

THE AVENDT GROUP, INC



RENUM001772

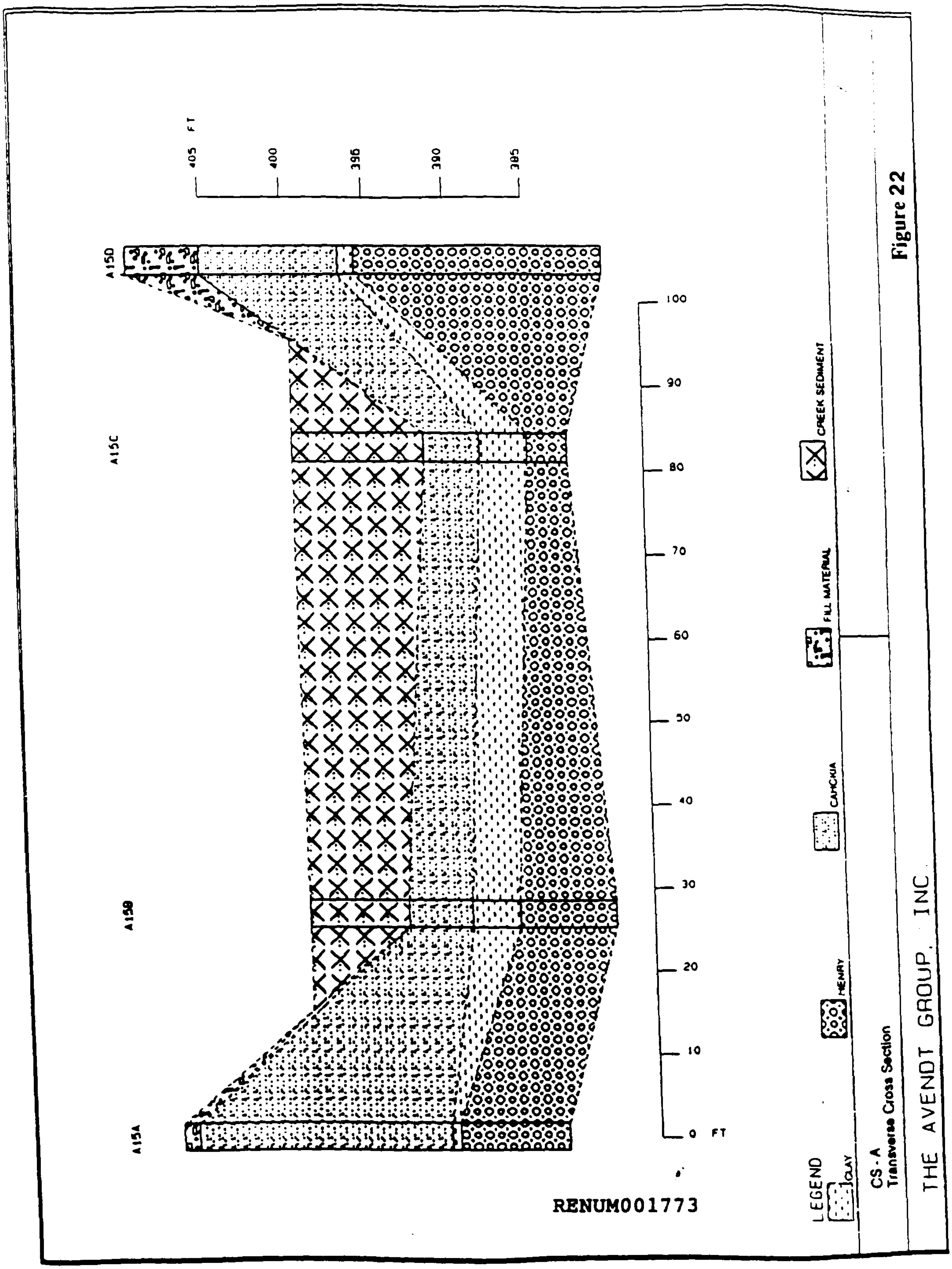
LEGEND

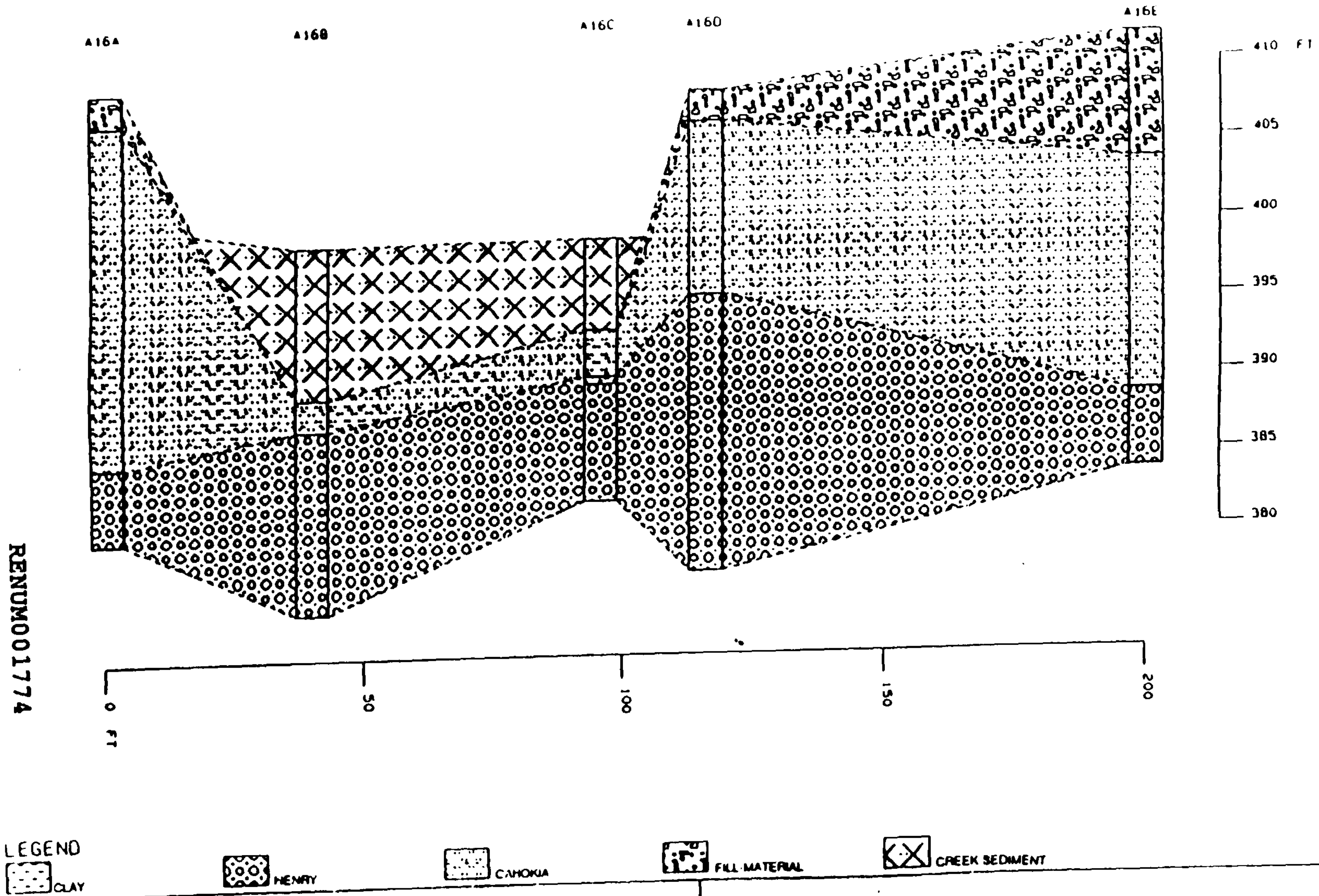
CLAY
HENRY
CAHOKIA
FILL-MATERIAL
CREEK SEDIMENT

CS - A
Transverse Cross Section

Figure 21

THE AVENDT GROUP, INC.


A15A
A15B
A15C
A15D
405 FT
400
395
390
385
0 FT
10
20
30
40
50
60
70
80
90
100
LEGEND
CLAY
HENRY
CAHOKIA
FILL MATERIAL
CREEK SEDIMENT
CS-A
Transverse Cross Section
THE AVENDT GROUP, INC.
Figure 22

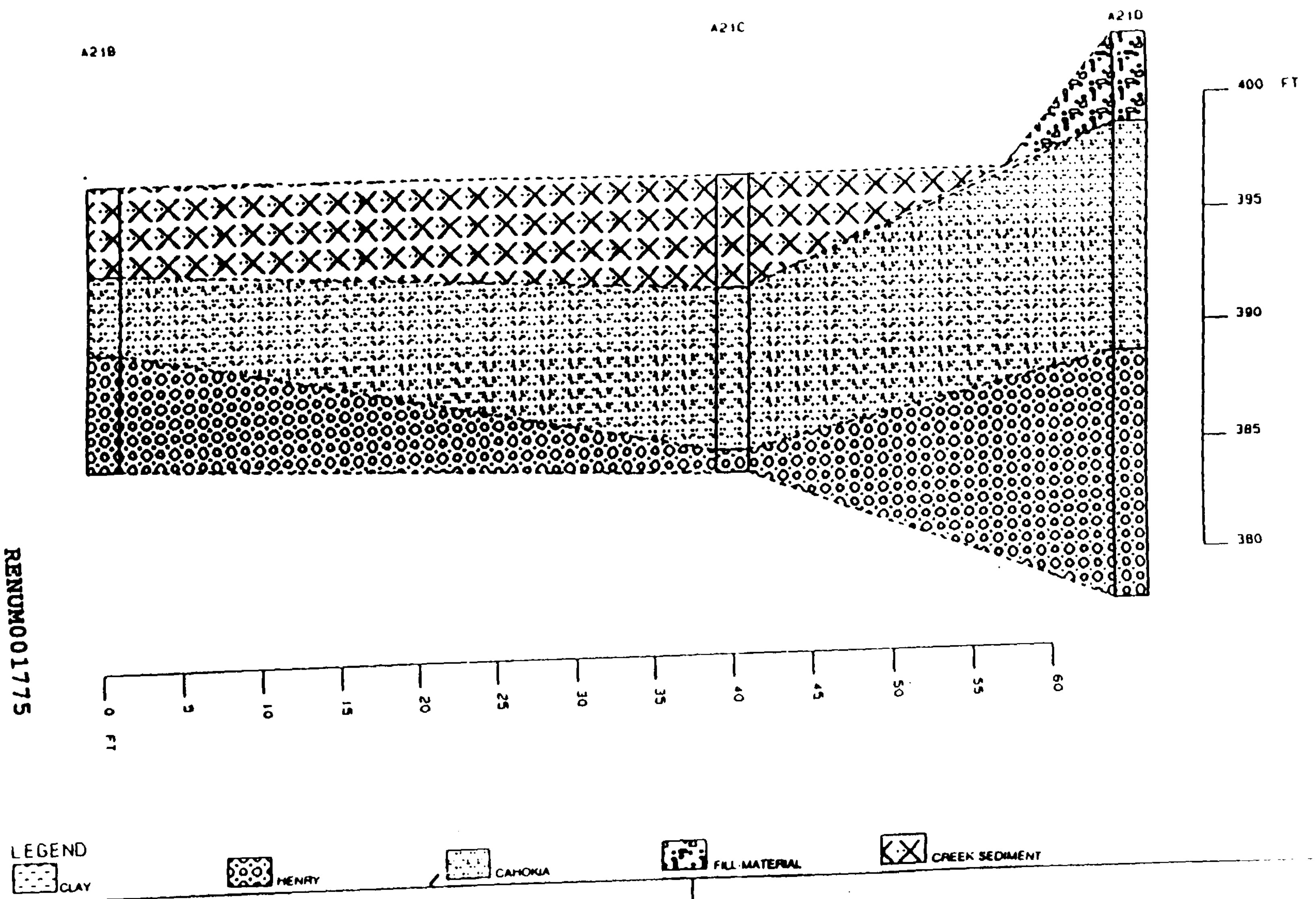


CS - A
Transverse Cross Section

Figure 23

THE AVENDT GROUP, INC.

RENUM001774



CS-A
Transverse Cross Section

Figure 24

THE AVENDT GROUP, INC

RENUM001775

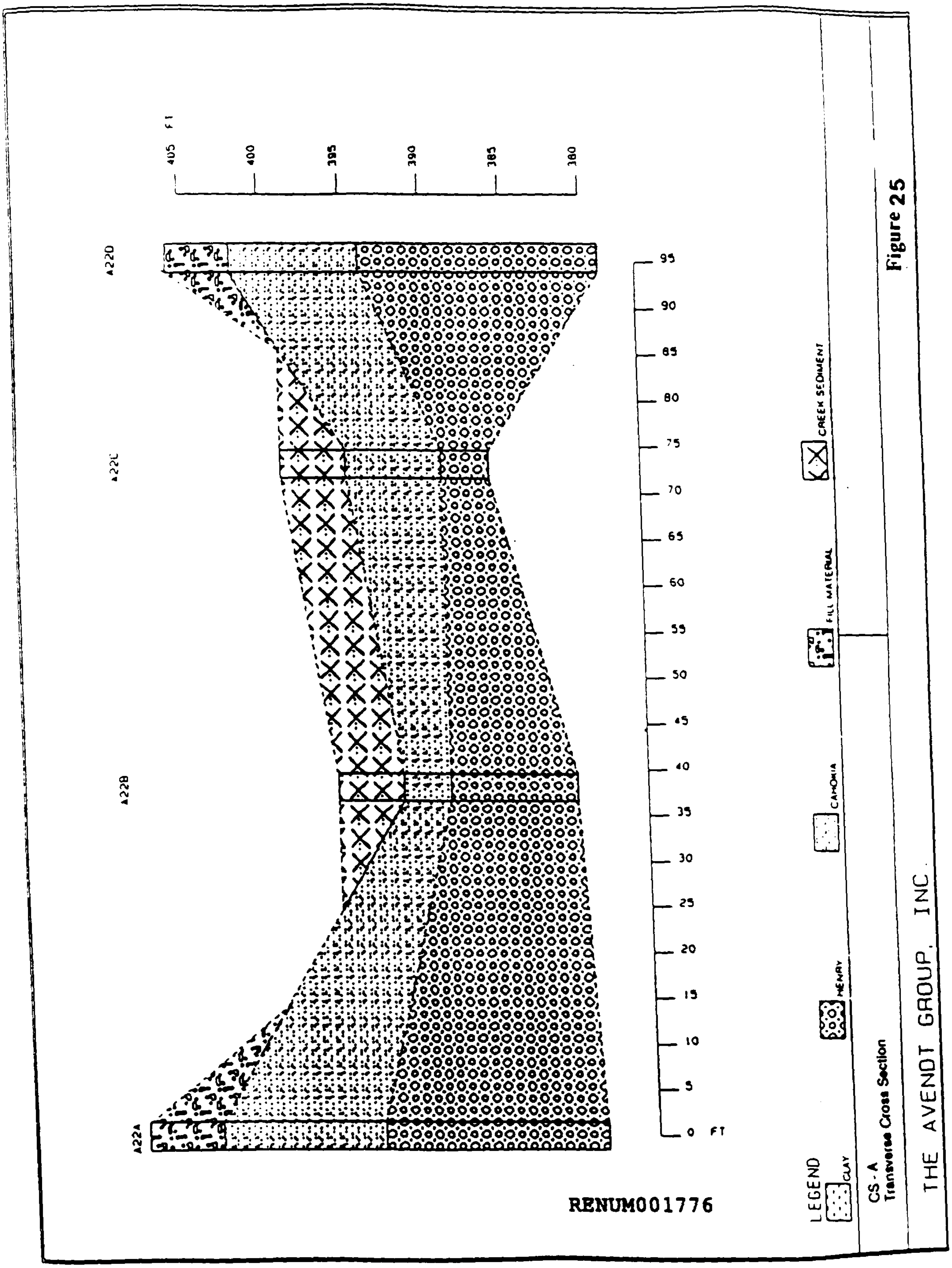

A22A
A22B
A22C
A22D
405 FT
400
395
390
385
380
0 FT
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
LEGEND
CLAY
HENRY
CAHOKIA
FILL MATERIAL
CREEK SEDIMENT
CS-A
Transverse Cross Section
THE AVENDT GROUP, INC.

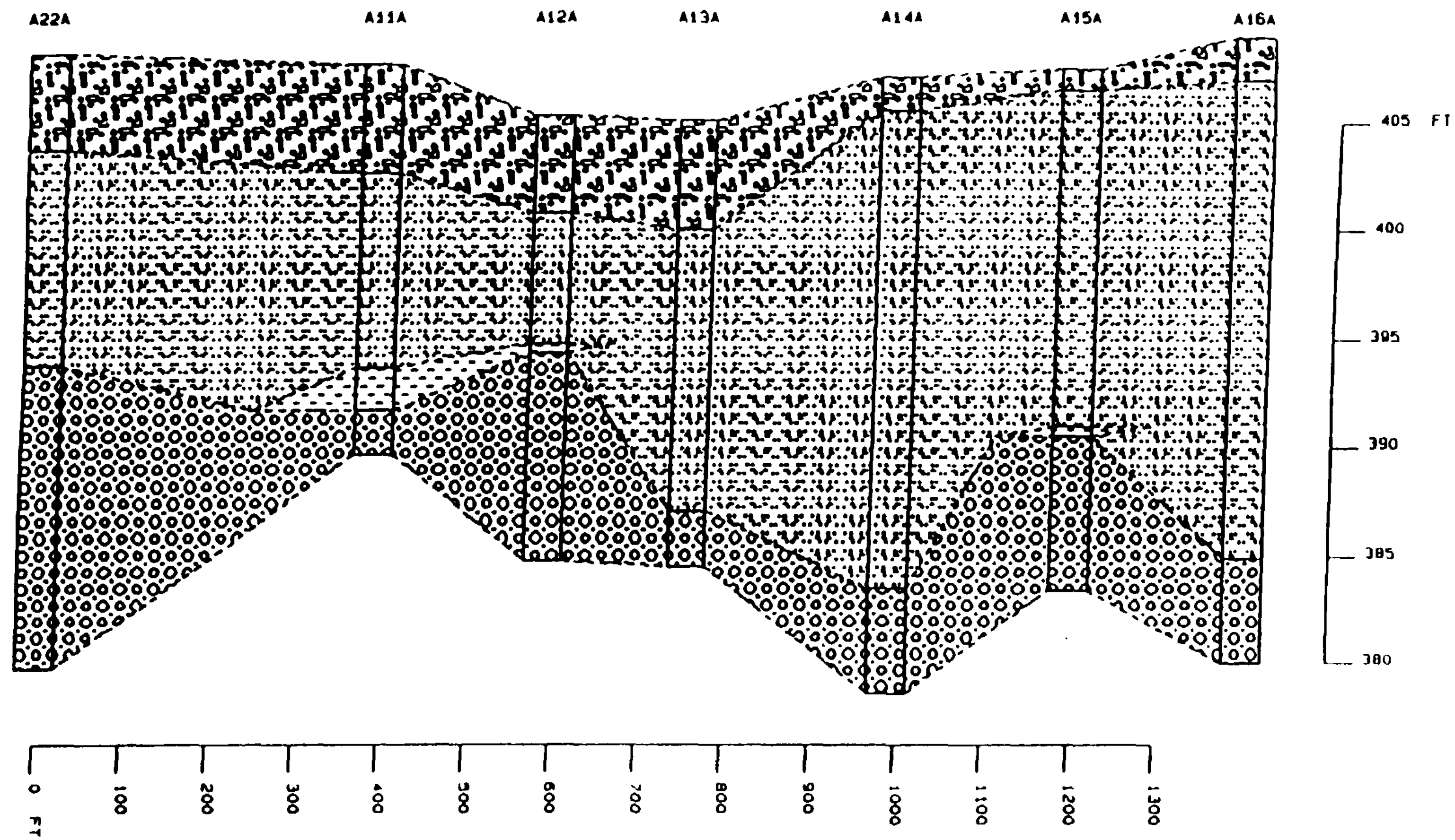
Figure 25

3.2.7.2 Longitudinal Sections

See figures on the following pages.

3.2.7.2
LONGITUDINAL SECTIONS

RENUM001778



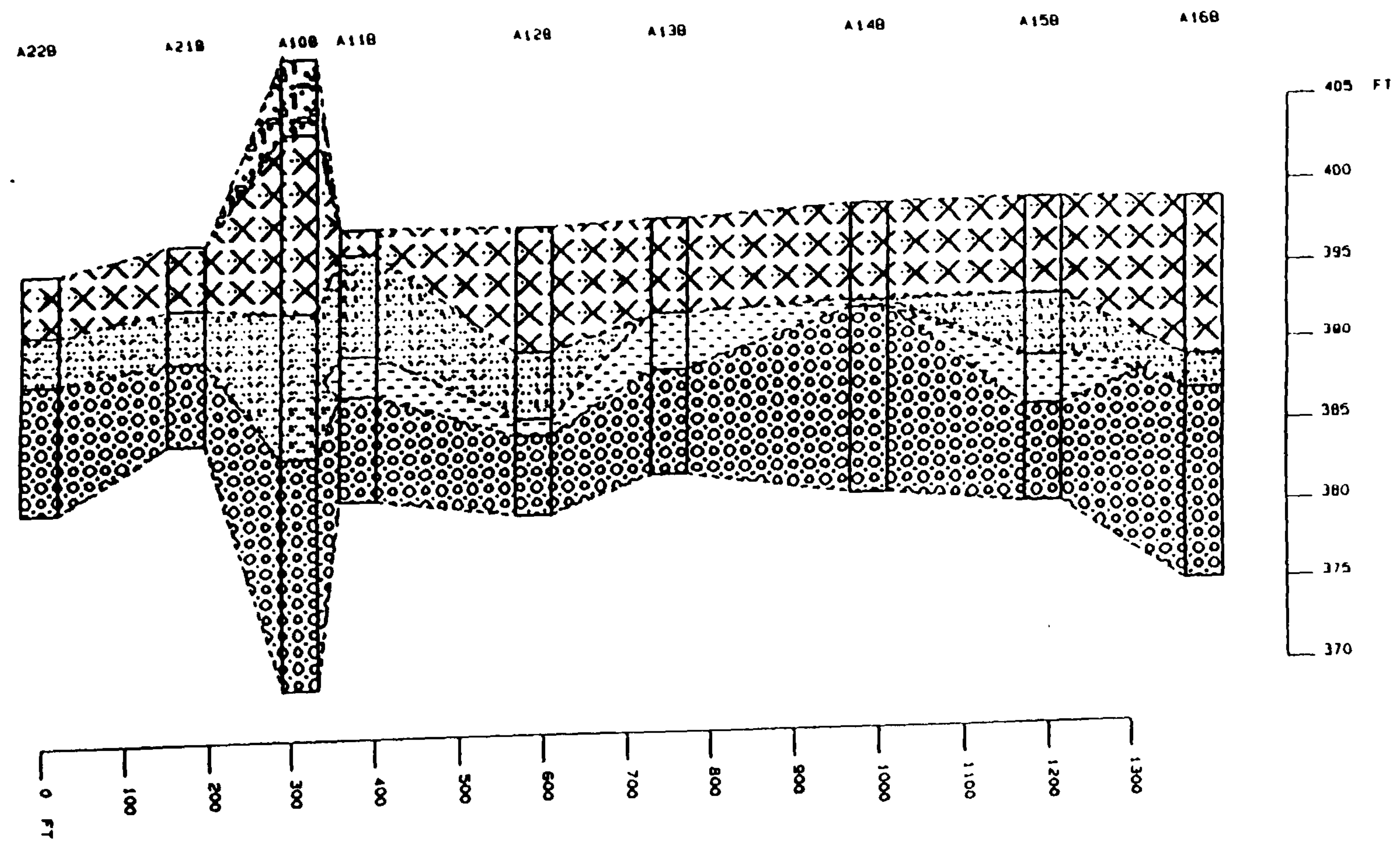
LEGEND

CLAY HENRY CAHOKIA FILL MATERIAL CREEK SEDIMENT

CS - A
Borehole Cross Sections

THE AVENDT GROUP, INC

Figure 26



RENUM001780

LEGEND

CLAY

HENRY

CAHOKIA

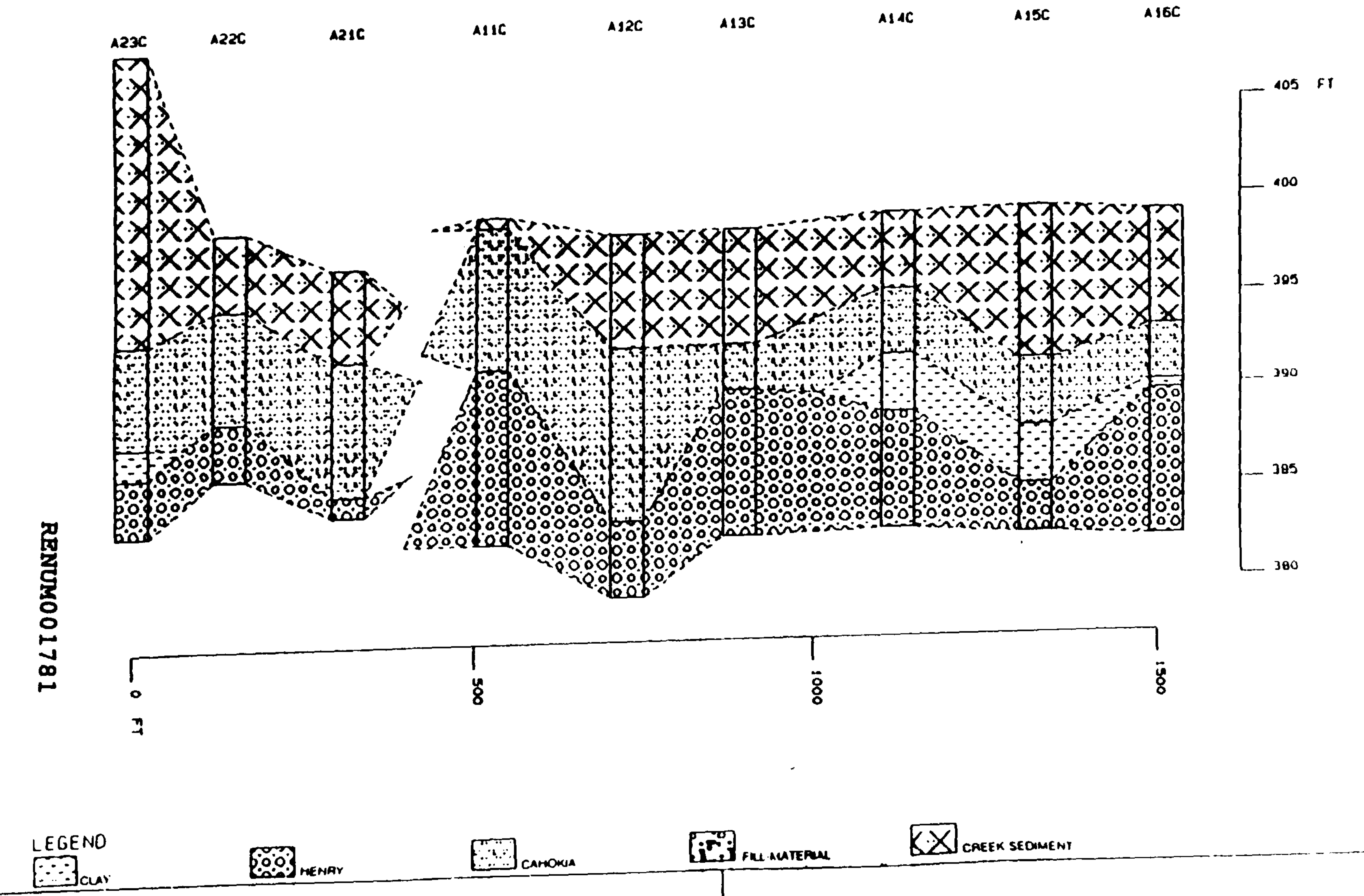
FILL MATERIAL

CREEK SEDIMENT

CS - A
Borehole Cross Sections

Figure 27

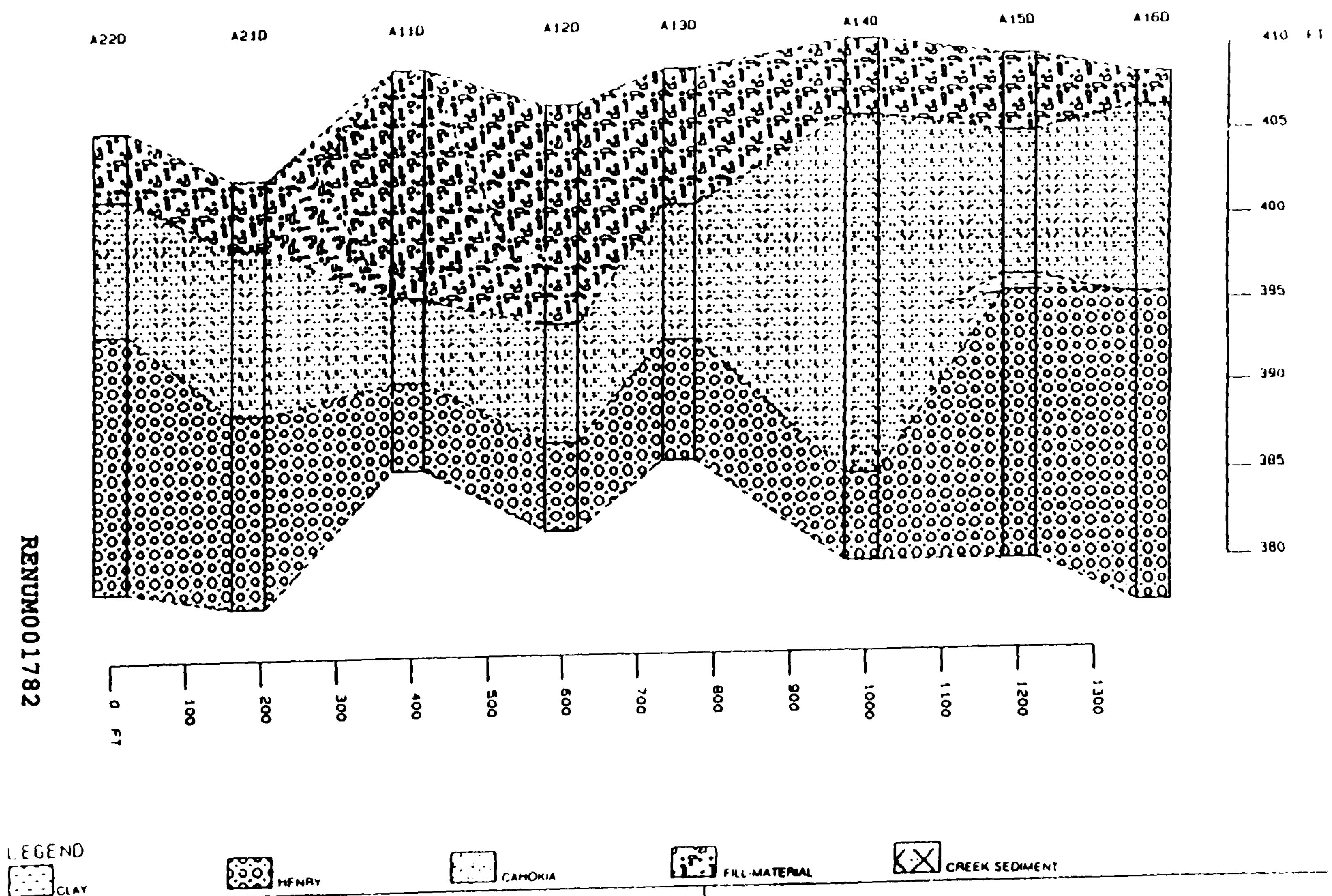
THE AVENDT GROUP, INC.



CS - A
Borehole Cross Sections

THE AVENDT GROUP, INC.

Figure 28



RENUM001782

CS - A
Borehole Cross Sections

THE AVENDT GROUP, INC.

Figure 29

3.2.7.3 Sediment Volume Determination and Physical Characteristics

It is estimated that there are nearly 19,500 cubic yards of bottom sediments in the Dead Creek Channel. The estimated volume of sediments was derived by subdividing the creek into eight discrete zones (Figure 17), measuring the width and length of each zone, and determining the average depth of the creek sediments in each zone. The volume of sediments in each zone was calculated and added together to determine the total volume of creek bottom sediments in the creek channel (Table 1).

The physical characteristics of the creek bottom sediments were characterized for the percent solids, water, ash and volatile content of the sediments, and are summarized in Table 2. The percent solids ranged from 12.2 to 72.9, and averaged 39.85 percent. The standard deviation for percent solids was 19.37. The percent water ranged from 27.1 to 87.8, and averaged 60.15 percent. The standard deviation for percent water was 19.63. The percent ash ranged from 75.3 to 94.9, and averaged 87.91 percent. The standard deviation for percent ash was 5.22. The percent volatiles ranged from 5.1 to 24.7, and averaged 12.10 percent. The standard deviation for percent volatiles was 5.75.

Review of the physical characteristics data indicates that the creek bottom sediments are relatively wet with a low total volatile organic content.

TABLE 1

CREEK SEGMENT A SEDIMENT VOLUME

Zone	Average Dimensions	(Feet)	Estimated Volume (Cubic Feet)	(Cubic Yards)
I	Width	60		
	Length	127	7,620	282
	Depth	1		
II	Width	66		
	Length	182	84,084	3,114
	Depth	7		
III	Width	61		
	Length	190	69,540	2,576
	Depth	6		
IV	Width	59		
	Length	223	65,785	2,436
	Depth	5		
V	Width	63		
	Length	201	88,641	3,283
	Depth	7		
VI	Width	67		
	Length	251	134,536	4,983
	Depth	8		
VII	Width	46		
	Length	156	28,704	1,063
	Depth	4		
VIII	Width	54		
	Length	189	45,927	1,701
	Depth	4.5		
Estimated Volume of Total Creek Sediment			524,837 cubic feet	19,438 cubic yards

TABLE 2

PHYSICAL CHARACTERISTICS
OF THE
CREEK SEGMENT A BOTTOM SEDIMENTS

SAMPLE	% Solids	% Water	% Ash*	% Volatile*
A12B 3 -7	12.2	87.8	89.0	11.0
A12C 4 -9	55.8	44.2	91.7	8.3
A13B 4.5-6	32.9	67.1	86.1	13.9
A13C 4 -8.5	41.0	59.0	91.3	8.7
A14B 4 -8.5	59.9	40.1	94.3	5.7
A14C 4 -8.5	23.1	76.9	87.2	12.8
A15C 4.5 -9	26.0	74.0	85.4	14.6
A16B 9 -12	23.5	76.5	75.3	24.7
A16C 2 -5	20.2	79.8	84.6	15.4
A21B 1 -6	40.3	59.7	80.6	19.4
A22B 0 -7	72.9	27.1	94.7	5.3
A22C 3 -9	70.4	29.6	94.9	5.1
Average	39.85	60.15	87.91	12.10
Standard Deviation	19.37	19.63	5.22	5.75

*Based on Dry Weight

3.3 Work Performed by Patterson Schafer, Inc.

3.3.1 Objectives

The overall purpose of the work being performed by Patterson Schafer, Inc., is to intercept and reroute all flows going to and from CS-A. The major objectives to accomplish this removal of flows were:

1) Intercept the stormwater presently discharged to CS-A and deliver the stormwater at a controlled rate to the Village of Sauget's combined sewerage system.

2) Design a new process water pumping station and system to provide a more controllable and measurable flow rate to the Village's sewerage system. This includes the prevention of any overflows into CS-A during overloads or power failures.

3) Seal the overflow opening of the Village of Sauget's sewer manhole near the north end of CS-A to prevent sanitary or combined sanitary/industrial wastewater from entering the creek via this route. (The Village of Sauget has already performed this task.)

4) Seal the north outfall of CS-A to prevent backflow of combined sanitary industrial wastes into the creek. This will be the final element of the project.

3.3.2 Description

The previous objectives are being accomplished through the construction of stormwater management facilities on Cerro Copper Products Co. property (Plate 3). This included a stormwater interceptor sewer system; junction manholes; a stormwater detention basin, including inlet and outlet structures, a stormwater pumping station and associated emergency generator; a force main; and associated piping, connections and appurtenances.

The interceptor sewer system is being constructed along the west side of CS-A. It is approximately 1,577 feet in length, and is constructed of ten-foot wide by five-foot high precast concrete culvert pipe, with walls approximately eight inches thick. The culvert will be three feet below grade along its southern half and approximately six inches below grade along its northern half. The slope of the culvert will drop approximately one foot along its length, from south to north.

Once the waters are transported through the sewer system, they are collected in a stormwater storage basin. Requirements and restrictions concerning the acceptable stormwater discharge rate to the Village sewer system were used in sizing this basin. It is roughly rectangular in shape, with dimensions of 215 feet by 50 feet, and capacity for approximately one million gallons, which includes the entire culvert system. The basin walls will be constructed of reinforced concrete, one foot thick, and the floor will be one and one-half feet thick. The basin is approximately five feet deep, with six inches above surface grade. The bottom slopes towards CS-A.

Flow into the basin will be controlled by gravity, and effluent from the storage basin will be controlled by a new pumping station. This station will prevent any overflows into CS-A. An emergency power generator will be provided in case of power failures.

The inlet to the Village's sewerage system will be modified to include "hardpiping" the 12-inch force main directly to the Village's sewerage system. This eliminates the use of the junction chamber and prevents any back flow into CS-A. All work is scheduled for completion by May 7, 1990.

RENUM001788

4.0 CHEMICAL CHARACTERIZATION

4.1 Sample Testing Summary and Explanation

The major objectives of the sampling and analysis rationale were the characterization and definition of hazardous constituents in CS-A, and their spatial distribution. To accomplish these objectives, CS-A was divided into two sections and characterized by collecting 99 samples through a network of 34 sediment/soil borings distributed on ten east-west transverses across CS-A. Characterization of CS-A was accomplished in a representative manner through various chemical analyses of samples from each boring and transverse. The chemical characterization of the samples included analysis for the following:

- Appendix IX Compounds
- Polychlorinated Biphenyls (PCBs)
- PCB Precursors
- EP Toxic Metals
- EP Toxic Pesticides and Herbicides
- HSL Total Metals
- Flash Point
- Reactivity
- pH

Table 3 indicates the type of analysis performed on each sample, the date that the sample was collected, and the sample number. The sampling program began July 5, 1989, and continued through July 21, 1989.

Fourteen (14) samples were analyzed for Appendix IX Compounds. The sampling and analysis rationale indicates there would be one Appendix IX analysis per transverse. However, an additional Appendix IX analysis was performed on transverses A11, A12, A15 and A16. These four additional analyses were based on field monitoring. Two additional Appendix IX analyses were also performed on transverse A10 and A23. These transverses were added to the project as a result of field conditions.

Table 3

CS-A

Sample Testing Summary

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A10B	6-7	7/13/89		XXX	XXX							
A10B	9-10	7/13/89		XXX	XXX							
A10B	15-17	7/13/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A10B	20-22	7/13-89		XXX	XXX							
A10B	24-29	7/13/89		XXX	XXX							
A10B	37-38	7/13/89		XXX	XXX							
A11A	8-13	7/19/89		XXX	XXX	XXX	XXX	XXX	XXX			
A11A	13-18	7/19/89		XXX	XXX							
.1B	4-8	7/18/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A11B	8.1-10.6	7/18/89		XXX	XXX							
A11B	12-17	7/18/89		XXX	XXX							
A11C	2-6/5	7/18/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A11C	6.5-10.5	7/18/89		XXX	XXX							
A11C	12.5-16.5	7/18/89		XXX	XXX							
A11D	8-10	7/18/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A11D	18.5-23.5	7/18.89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A12A	8-11	7/19/89		XXX	XXX	XXX	XXX	XXX	XXX			
A12A	11-20.5	7/19/89		XXX	XXX							
A12B	3-7	7/13/89	XXX	XXX	•••	•••	XXX			XXX	XXX	XXX
'12B	9-12	7/13/89		XXX	XXX							
A12B	14-17	7/13/89		XXX	XXX							

RENUM001790

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A12B	17-19	7/13/89		XXX	XXX							
A12C	14-16	7/12/89			XXX		XXX					
A12C	10-13	7/12/89			XXX		XXX					
A12C	4-9	7/12/89	XXX		•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A12D	6-13	7/18/89		XXX	XXX							
A12D	17-20	7/18/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A12D	20-25	7/18/89		XXX	XXX							
A13A	9-14	7/20/89		XXX	XXX		XXX	XXX	XXX			
A13A	14-19	7/20/89		XXX	XXX							
A13A	19-20.5	7/20/89		XXX	XXX							
A13B	4.5-6.0	7/11/89	XXX		•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A13B	6-9.5	7/11/89			XXX							
A13B	9.5-12	7/11/89			XXX							
A13C	13-16	7/12/89			XXX		XXX					
A13C	6-13	7/12/89			XXX		XXX					
A13C	4-8.5	7/12/89			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A13D	18-23	7/19/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A14A	4-9	7/20/89		XXX	XXX	XXX	XXX	XXX	XXX			
A14A	13.5-23.5	7/20/89		XXX	XXX							
A14A	23.5-28.5	7/20/89		XXX	XXX							
A14B	4-8.5	7/11/89			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A14B	8.5-13	7/11/89			XXX							

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A14C	4-8.5	7/11/89			XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A14C	8.5-10.5	7/11/89	XXX		...	...						
A14C	13.5-16.5	7/11/89			XXX							
A14C	9-14	7/11/89			XXX		XXX					
A14D	10-14	7/12/89			XXX	XXX	XXX			XXX	XXX	XXX
A14D	15-19	7/12/89			XXX							
A14D	24-29	7/12/89			XXX							
A15A	9-14	7/20/89		XXX	XXX		XXX	XXX	XXX			
A15A	14-19	7/20/89		XXX	XXX							
A15A	19-24	7/20/89		XXX	XXX							
A15B	6-9	7/7/89	XXX		...	...	XXX			XXX	XXX	XXX
A15B	13-16	7/7/89			XXX	XXX	XXX	XXX	XXX			
A15B	16-19	7/7/89			XXX							
A15C	4.5-9	7/7/89	XXX		...	...	XXX	XXX	XXX	XXX	XXX	XXX
A15C	9.5-14.5	7/10/89			XXX							
A15C	14.5-17.5	7/10/89			XXX							
A15D	4-9	7/12/89			XXX	XXX	XXX			XXX	XXX	XXX
A15D	12-14	7/2/89			XXX							
A15D	19-24	7/12/89			XXX							
A15D	24-29	7/12/89			XXX							
A16A	9-14	7/20/89		XXX	XXX		XXX	XXX	XXX			
A16A	14-19	7/20/89		XXX	XXX							

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS.	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A16A	24-29	7/20/89		XXX	XXX							
A16B	9-12	7/18/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A16B	14-19	7/18/89		XXX	XXX							
A16C	2-5	7/18/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A16C	7-12	7/18/89		XXX	XXX							
A16C	12-17	7/18/89		XXX	XXX							
A16D	13-18	7/20/89		XXX	XXX							
A16D	18-23	7/20/89		XXX	XXX							
A16D	23-31	7/20/89		XXX	XXX							
A16E	13-18	7/20/89		XXX	XXX		XXX	XXX	XXX			
A16E	18-23	7/20/89		XXX	XXX							
A16E	25.5-28	7/20/89		XXX	XXX							
A21B	1-6	7/17/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A21B	6-10	7/17/89		XXX	XXX							
A21B	10-13	7/17/89		XXX	XXX							
A21C	4-8	7/14/89	XXX	XXX	•••	•••	XXX	XXX	XXX	XXX	XXX	XXX
A21C	8-11	7/14/89		XXX	XXX							
A21C	13-14.5	7/14/89		XXX	XXX							
A21D	4-9	7/10/89			XXX							
A21D	9-14	7/10/89			XXX							
A21D	14-19	7/10/89			XXX	XXX	XXX	XXX	XXX			
A22A	19-22	7/11/89			XXX							

Table 3
(Cont.)

SAMPLE ID		DATE	APPENDIX IX	PRE	PCB'S	HSL TOTAL METALS	E.P. TOXICITY METALS	E.P. TOXICITY PESTS	E.P. TOXICITY HERBS	FLASH POINT	pH	REACTIVITY
A22A	24-28	7/11/89			XXX							
A22B	0-7	7/17/89	XXX	XXX	***	***	XXX	XXX	XXX	XXX	XXX	XXX
A22B	7-13	7/17/89		XXX	XXX							
A22C	3-9	7/17/89		XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
A22C	10-15	7/17/89		XXX	XXX							
A22D	4-9	7/11/89			XXX							
A22D	9-14	7/11/89			XXX							
A22D	24-27	7/11/89			XXX							
A23C	12-13	7/14/89		XXX	XXX							
A23C	13-19	7/14/98		XXX	XXX							
A23C	19-20	7/14/89	XXX	XXX	***	***	XXX	XXX	XXX	XXX	XXX	XXX
A23C	21-23	7/14/89		XXX	XXX							

*** Included in the Appendix IX Parameter Lists

Pre : indicates PCB precursor analysis

RENUM001794

All samples taken during the investigation were analyzed for Polychlorinated Biphenyls (PCBs). This resulted in a total of ninety-nine (99) samples being analyzed for PCBs. Furthermore, sixty-three (63) of these samples were also analyzed for characteristic PCB Precursors.

- Biphenyl
- Chlorobiphenyl
- Dichlorobiphenyl
- Trichlorobiphenyl
- Tetrachlorobiphenyl
- Pentachlorobiphenyl
- Hexachlorobiphenyl
- Decachlorobiphenyl

Thirty-nine (39) samples were analyzed for the eight RCRA metals using the EP Toxicity Test. The eight RCRA metals consisted of Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg), Silver (Ag) and Selenium (Se). According to the sampling and analysis rationale, a sample for EP Toxicity was to be taken from each boring. However, five additional EP Toxicity tests were performed based on sample appearance in the field. These five additional tests were performed on borings A12C (two samples), A13C (two samples), and A11D. Twenty-nine (29) samples were analyzed for herbicides and pesticides using the EP Toxicity Test.

Thirty (30) samples were characterized for the HSL Total Metals concentrations. The sampling and analysis rationale indicates that one HSL Total Metals analysis was to have been analyzed in each boring. However, no HSL Total Metals analyses were performed on any sample from borings A13A, A15A, A16A, A16D, A16E, A22A and A22D. This was based on sample appearance in the field.

Twenty-four (24) samples were analyzed for the characteristics of ignitability, reactivity and corrosivity.

Table 4

CS - A

PCB Analysis (ppb)

Sample I.D.		Date	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-126
A10	6-7	07/13	ND	ND	ND	ND	ND	ND	ND
A10	9-10	07/13	ND	ND	ND	ND	ND	ND	ND
A10	15-17		ND	ND	ND	ND	ND	480	ND
A10	20-22	07/13	ND	ND	ND	ND	ND	1400	ND
A10	24-29	07/13	ND	10000	ND	ND	ND	4300	ND
A10	37-38	07/13	ND	3200	ND	ND	ND	880	ND
A11A	8-13	07/19	ND	ND	ND	ND	ND	0.00	ND
A11A	13-18	07/19	ND	ND	ND	ND	ND	ND	ND
A11B	4-8		ND	ND	ND	ND	ND	530	ND
A11B	8.1-10.6	07/18	ND	ND	ND	ND	ND	210	ND
A11B	12-17	07/18	ND	ND	ND	ND	ND	920	ND
A11C	2-6.5		ND	ND	45000	ND	ND	10000	ND
A11C	6.5-10.5	07/18	ND	ND	ND	ND	ND	13000	ND
A11C	12.5-16.5	7/18	ND	ND	ND	ND	ND	1300	ND
A11D	8-10	07/18	ND	ND	ND	ND	ND	ND	ND
A11D	18.5-23.5	7/18	ND	ND	ND	ND	ND	ND	38000
A12A	8-11	07/19	ND	ND	ND	ND	ND	ND	ND
A12A	11-20.5	07/19	ND	ND	ND	ND	ND	67	ND
A12B	3-7		ND	ND	32000	ND	ND	ND	ND
A12B	9-12	07/13	ND	13000	ND	ND	ND	830	ND
A12B	14-17	07/13	ND	ND	ND	ND	ND	ND	ND
A12B	17-19	07/13	ND	ND	ND	ND	ND	270	ND
A12C	4-9		ND	ND	ND	ND	ND	ND	ND
A12C	10-13	07/12	ND	ND	ND	ND	ND	ND	ND
A12C	14-16	07/12	ND	ND	ND	ND	ND	ND	ND
A12D	6-13	07/18	ND	ND	ND	ND	ND	530000	ND
A12D	17-20	07/18	ND	ND	ND	ND	29000	ND	72000
A12D	20-25	07/18	ND	ND	ND	ND	6700	ND	9100
A13A	9-14	07/20	ND	ND	ND	ND	ND	ND	ND
A13A	14-19	07/20	ND	ND	ND	ND	ND	ND	ND
A13A	19-20.5	07/20	ND	ND	ND	ND	ND	ND	ND
A13B	4.5-6		ND	ND	340000	ND	ND	100000	ND
A13B	6-9.5	07/11	ND	ND	32000	ND	ND	18000	ND
A13B	9.5-12	07/11	ND	1900	ND	ND	ND	350	ND
A13C	4-8.5	07/12	ND	780000	ND	ND	ND	130000	ND
A13C	6-13	07/12	ND	20000	ND	ND	ND	5500	ND
A13C	13-16	07/12	ND	ND	ND	ND	ND	ND	ND
A13D	18-23	07/19	ND	ND	ND	ND	ND	670	630
A14A	4-9	07/20	ND	ND	ND	ND	ND	99	ND
A14A	13.5-23.5	7/20	ND	ND	ND	ND	ND	62	ND
A14A	23.5-28.5	7/20	ND	ND	ND	ND	ND	ND	ND
A14B	4-8.5	07/11	ND	100000	ND	ND	ND	14000	ND
A14B	8.5-13	07/11	ND	5200	ND	ND	ND	1100	ND
A14C	4-8.5	07/11	ND	190000	ND	ND	ND	350000	ND
A14C	8.5-10.5		ND	ND	1700	ND	ND	520	ND
A14C	13.5-16.5	07/11	ND	5200	ND	ND	ND	1000	ND
A14D	10-14	07/12	ND	ND	ND	ND	ND	ND	ND
A14D	15-19	07/12	ND	ND	ND	ND	ND	ND	ND
A14D	24-29	07/12	ND	ND	ND	ND	ND	ND	ND

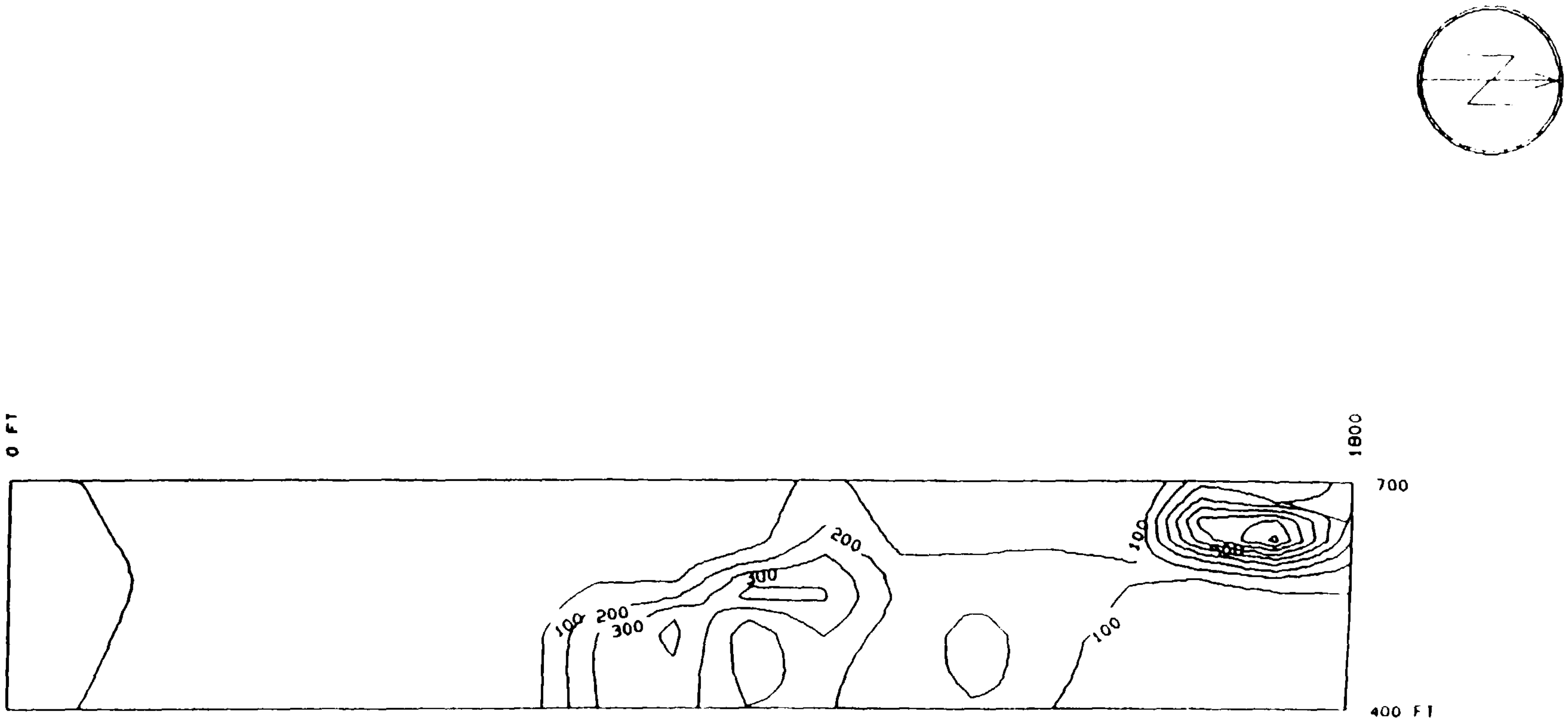
Table 4
(Cont.)

Sample I.D.		Date	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
A15B	6-9		ND	ND	3700	ND	ND	ND	ND
A15B	13-16	07/07	ND	ND	7200	ND	ND	1800	ND
A15B	16-19	07/07	ND	ND	ND	ND	ND	ND	ND
A15C	4.5-9		ND	ND	300000	ND	ND	68000	ND
A15C	9.5-14.5	07/10	ND	1500	ND	ND	ND	160	ND
A15C	14.5-17.5	07/10	ND	15000	ND	ND	ND	2300	ND
A15D	4-9	07/12	ND	ND	ND	ND	ND	ND	ND
A15D	12-14	07/12	ND	ND	ND	ND	ND	ND	ND
A15D	19-24	07/12	ND	ND	ND	ND	ND	ND	ND
A15D	24-29	07/12	ND	ND	ND	ND	ND	ND	ND
A16A	9-14	07/20	ND	ND	ND	ND	ND	ND	ND
A16A	14-19	07/20	ND	ND	ND	ND	ND	2100	860
A16A	24-29	07/20	ND	ND	ND	ND	ND	ND	ND
A16B	9-12		ND	ND	1600000	ND	ND	ND	ND
A16B	14-19	07/18	ND	ND	ND	5400	ND	ND	ND
A16C	2-5		ND	ND	ND	ND	BDL	ND	ND
A16C	7-12	07/18	ND	ND	ND	13000	ND	ND	ND
A16C	12-17	07/18	ND	ND	ND	1100	ND	450	ND
[illegible]	13-18	07/20	ND	ND	ND	ND	ND	ND	ND
	18-23	07/20	ND	ND	ND	ND	ND	90	ND
A16D	23-31	07/20	ND	ND	ND	ND	ND	ND	ND
A16E	13-18	07/20	ND	ND	ND	ND	520	290	ND
A16E	18-23	07/20	ND	ND	ND	ND	1300	690	ND
A16E	25.5-28	07/20	ND	ND	ND	ND	550	400	ND
A21B	1-6	07/17	ND	ND	ND	ND	ND	ND	27000
A21B	6-10	07/17	ND	ND	ND	ND	ND	200	ND
A21B	10-13	07/17	ND	ND	ND	ND	ND	ND	ND
A21C	4-8		ND	ND	ND	ND	ND	ND	30000
A21C	8-11	07/14	ND	ND	ND	ND	ND	ND	ND
A21C	13-14.5	07/14	ND	ND	ND	ND	ND	ND	ND
A21D	4-9	07/10	ND	ND	ND	ND	ND	90	ND
A21D	9-14	07/10	ND	ND	ND	ND	ND	150	ND
A21D	14-19	07/10	ND	ND	ND	ND	ND	ND	ND
A22A	9-14	07/11	ND	ND	ND	ND	ND	ND	ND
A22A	19-22	07/11	ND	ND	ND	ND	ND	ND	ND
A22A	24-28	07/11	ND	ND	ND	ND	ND	ND	ND
A22B	0-7		ND	ND	ND	ND	120000	ND	ND
A22B	7-13	07/17	ND	ND	ND	ND	ND	ND	ND
A22C	3-9	07/17	ND	ND	ND	ND	ND	19000	ND
A22C	10-15	07/17	ND	ND	ND	ND	ND	ND	ND
A22D	4-9	07/11	ND	ND	ND	ND	ND	ND	12000
A22D	9-14	07/11	ND	ND	ND	ND	ND	ND	ND
A22D	24-27	07/11	ND	ND	ND	ND	ND	ND	ND
[illegible]	12-13	07/14	ND	ND	ND	ND	3300	ND	690
	13-19	07/14	ND	ND	ND	ND	5700	ND	1200
A23A	19-20		ND	ND	ND	ND	150000	ND	ND
A23A	21-23	07/14	ND	ND	ND	ND	1600	ND	ND

** units : ug/kg **

4.2.3 Contour Maps - PCB/Biphenyls

See Figures on the following pages.



CS - A
PCB's Greatest Concentrations

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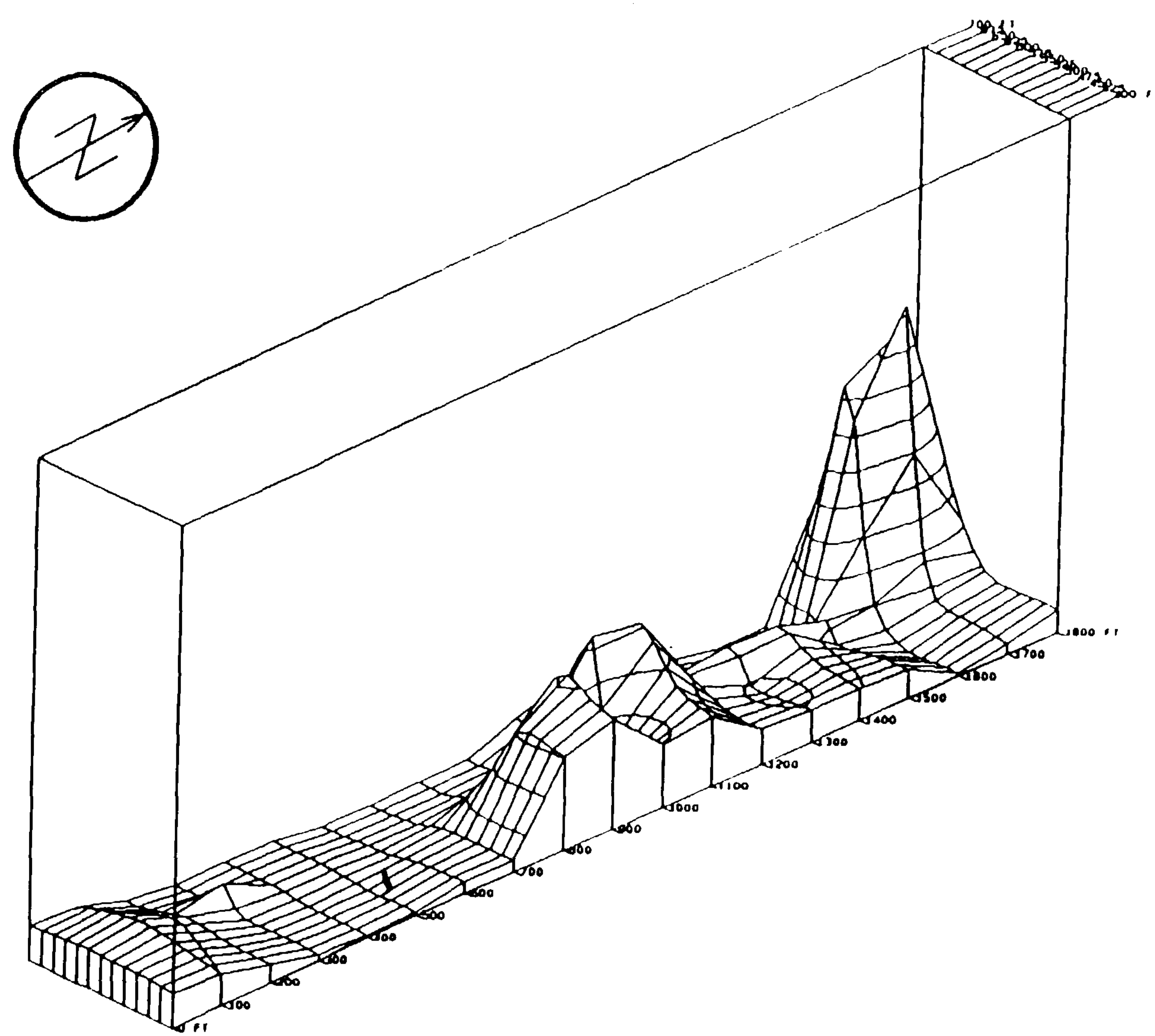
Figure 30



CS - A
PCB's Greatest Concentrations

THE AVENDT GROUP, INC.

Figure 31

Table 5

CS - A

PCB Precursor Concentrations

Sample:	A11b	A11b	A11b	A11c	A11c	A11c	A11d	A12a	A12d	A12d	A12d
Depth:	4-8	8.1-10.6	12-17	2-6.5	6.5-10.5	12.5-16.5	18.5-23.5	18-23	6-13	17-20	20-25
Compounds:											
Biphenyl	6.6 J	1.5 J	0.2	5.2 J	BDL	BDL	BDL	BDL	BDL	0.3	0.04
Chlorobiphenyl	BDL	BDL	BDL	0.9 J	BDL	BDL	BDL	0.04	3.6 J	0.03	0.04
Dichlorobiphenyl	BDL	BDL	BDL	1.5 J	BDL	BDL	BDL	BDL	35.0 J	0.3	0.06
Trichlorobiphenyl	BDL	BDL	BDL	0.2 J	BDL	BDL	BDL	BDL	60.0 J	0.7	0.2
Tetrachlorobiphenyl	BDL	BDL	0.01	0.1 J	0.3 J	BDL	0.5	0.01	75.0 J	1.0	0.3
Pentachlorobiphenyl	BDL	BDL	0.04	0.1 J	0.9 J	0.03	1.3	0.02	69.0 J	1.0	0.3
Hexachlorobiphenyl	BDL	BDL	0.04	BDL	BDL	0.07	3.8	0.05	210.0 J	2.3	0.7
Decachlorobiphenyl	BDL	BDL	BDL	BDL	BDL	BDL	3.0	BDL	BDL	BDL	BDL

Sample:	A16a	A16b	A16b	A16c	A16c	A16d	A16d	A16e	A16e	A16e
Depth:	14-19	9-12	14-19	2-5	7-12	18-23	23-31	13-18	18-23	25.5-28
Compounds:										
Biphenyl	BDL	8.3 J	1.0 J	24.0 J	1.2 J	0.02	BDL	BDL	BDL	BDL
Chlorobiphenyl	BDL	1.8 J	0.3 J	6.0 J	0.4 J	BDL	BDL	BDL	BDL	BDL
Dichlorobiphenyl	BDL	5.3 J	0.7 J	26.0 J	0.8 J	0.03	BDL	BDL	BDL	BDL
Trichlorobiphenyl	0.01	3.8 J	0.5 J	24.0 J	0.7 J	0.04	BDL	BDL	0.02	0.03
Tetrachlorobiphenyl	0.06	4.3 J	0.3 J	21.0 J	0.4 J	0.06	0.02	0.04	0.09	0.10
Pentachlorobiphenyl	0.13	BDL	0.2 J	8.6 J	BDL	0.10	0.02	BDL	0.05	0.03
Hexachlorobiphenyl	0.12	BDL	0.08 J	BDL	BDL	0.23	BDL	BDL	BDL	BDL
Decachlorobiphenyl	0.09	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

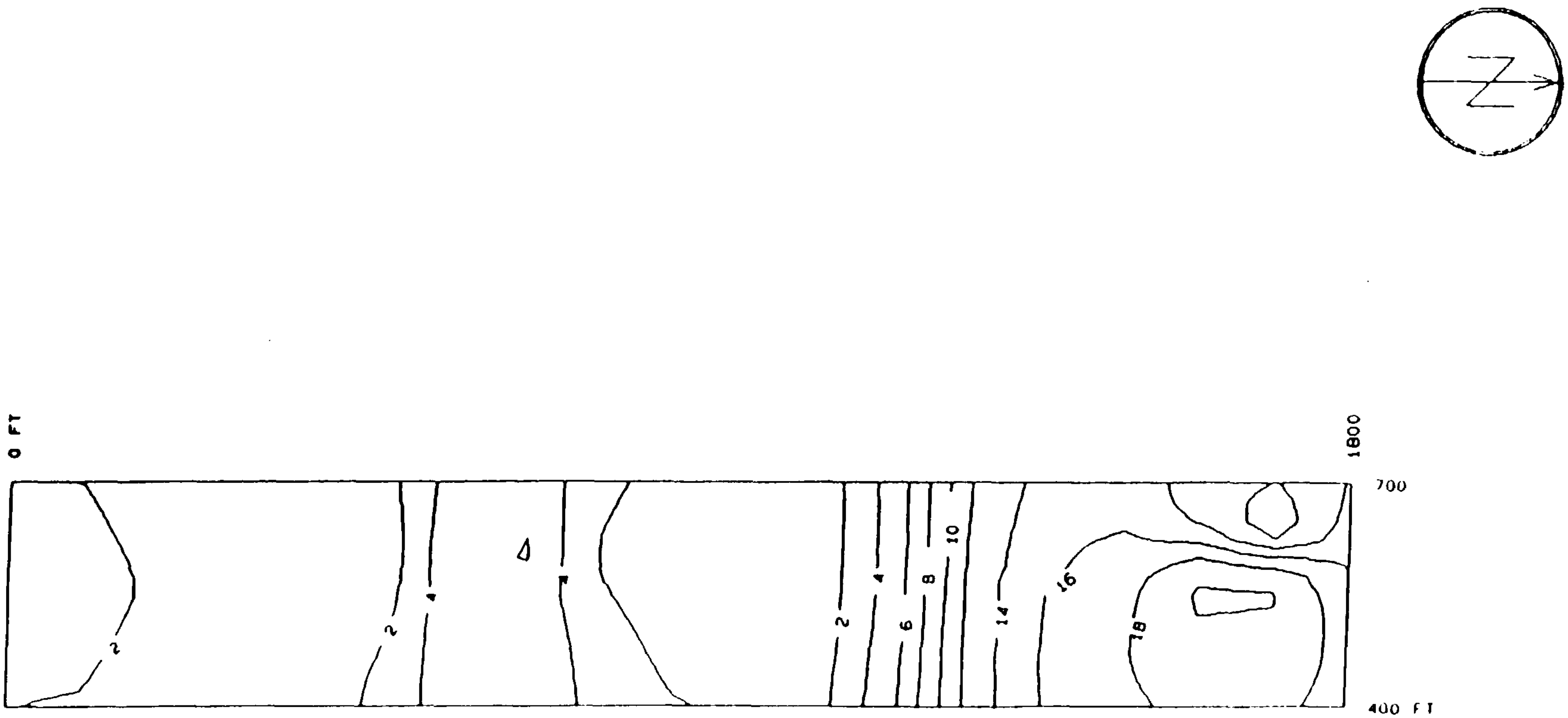
Units: Mg/Kg

J = Indicates a positive identification of the compound, however the concentration is an estimated value.

BDL = Below detection limits

** The following samples showed BDL readings for all precursor parameters:

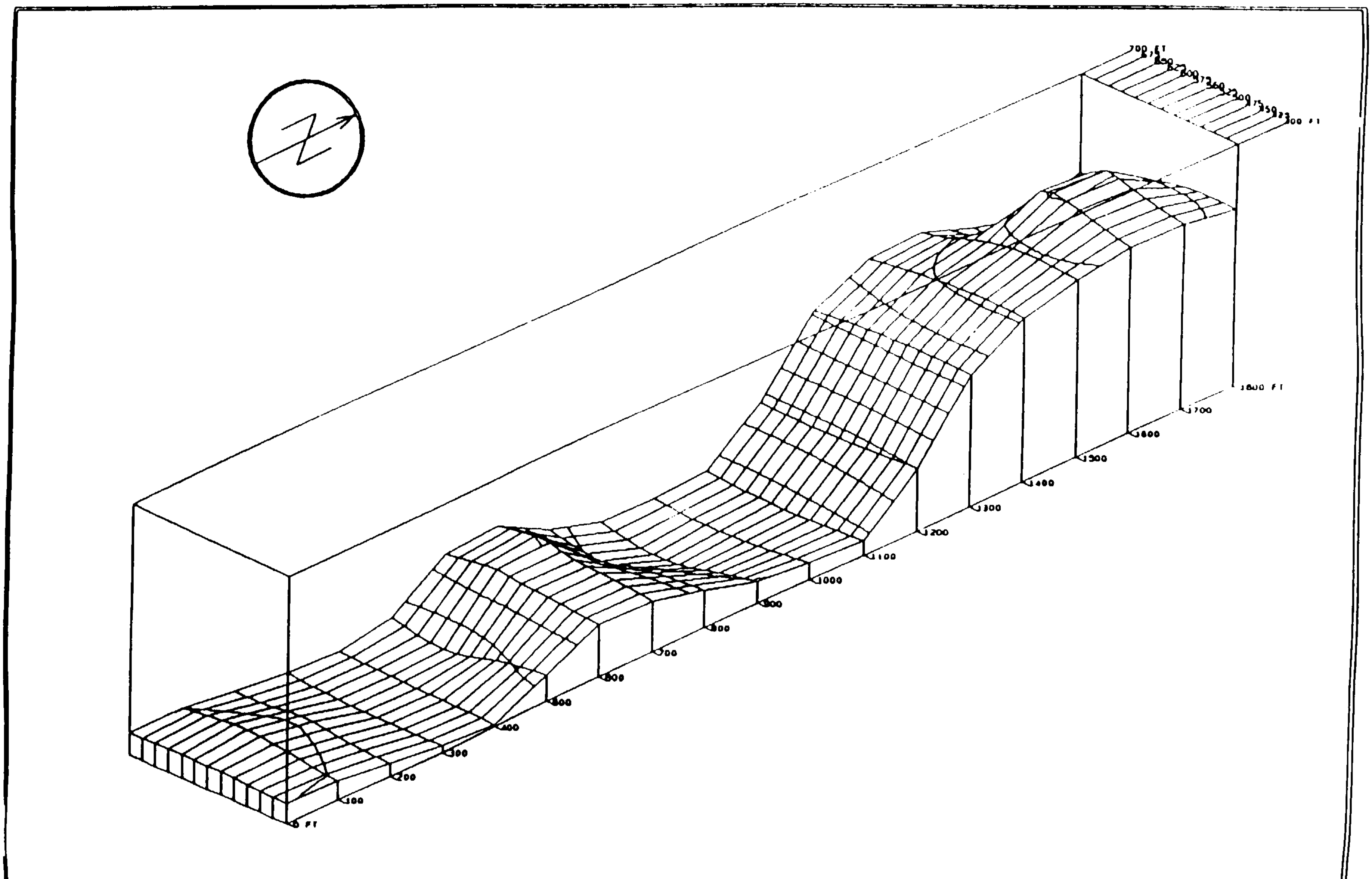
A10 6-7; A10 9-10; A10 15-17; A11a 13-18; A11a 8-13; A11d 8-10; A12a 8-11; A12a 11-20.5; A12a 18-23; A12b 3-7 A12b 9-12; A12b 14-17; A12b 17-19; A13a 9-14; A13a 14-19; A13a 19-20.5; A14a 4-9; A14a 13.5-23.5; A14a 23.5-28.5 A15a 9-14; A15a 14-19; A15a 19-24; A16a 9-14; A16a 24-29; A16c 12-17; A16d 13-18; A16d 18-23; A16e 25.5-28; A21b 6-10; A21b 10-13; A21c 4-8; A21c 8-11; A21c 13-14.5; A22b 7-13; A22c 10-15



CS - A
Biphenyl Concentrations

THE AVENDT GROUP, INC

Figure 32



CS - A
Biphenyl Concentrations

X. Y. Z=1. 1. 30

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Figure 33

4.3 Extraction Procedure Toxicity Test (EP Tox)

There were 39 samples characterized for the eight RCRA metals through the EP Toxicity test, SW-846 Method 1310. The eight RCRA metals consisted of Arsenic (As), Barium (Ba), Cadmium (Cd), Chromium (Cr), Lead (Pb), Mercury (Hg), Silver (Ag), and Selenium (Se). The sampling and analysis rationale indicated that one sample from each boring would be analyzed for EP Toxicity. However, five additional EP Toxicity tests were performed, two in boring A12C, two in boring A13C, and one in boring A11D, based on sample appearance in the field. The pesticides and herbicides were analyzed through the EP Tox procedure.

4.3.1 EP Toxicity Metals Analysis

The method of analyses for the eight RCRA metals were as follows:

Arsenic	SW 846 Method 7061
Barium	SW 846 Method 7080
Cadmium	SW 846 Method 7130
Chromium	SW 846 Method 7190
Lead	SW 846 Method 7420
Mercury	SW 846 Method 7470
Selenium	SW 846 Method 7741
Silver	SW 846 Method 7760

EP Tox analysis was run for the eight (8) EP Tox RCRA metals (Table 6). Laboratory data for arsenic, barium, chromium, mercury, selenium and silver were within allowable EP Tox limits (Table 6). Isolated samples from locations in the southern one-third to one-half of CS-A analyzed for Cd and Pb were above EP Tox values (Table 6; Figures 34 through 37).

Table 6

CS - A

EPTOX Analyses

Sample ID	A10 15-17	A11A 8-13	A11B 4-8	A11C 2-6.5	A11D 8-10	A11D 10.5-23.5	A12A 8-11	A12B 3-7	A12C 4-8	A12C 10-13	A12C 14-16	A12D 17-20	A13B 4.5-6	A13C 4-8.5	A13C 8-13	A13C 13-16	A13D 18-23	A14B 4-8.5	A14C 4-8.5	A14D 10-14	A15B 6-9	A15B 13-16	A15C 4.5-9	A15D 4-9	A16A 9-14	A16B 9-12	A16C 2-5	A16B 13-18	A21B 1-6	A21C 4-8	A21D 14-19	A22A 9-14	A22B 0-7	A22C 3-9	A22D 4-9	A23A 19-20	Maximum Allowable Concentrations
Parameters																																					
Silver	ND	ND	ND	0.024	0.037	0.028	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.032	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.024	5.0
Arsenic	ND	ND	ND	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.010	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.018	ND	ND	0.35	ND	ND	ND	ND	ND	ND	ND	5.0
Barium	1.3	ND	1.8	1.2	2.6	1.0	1.4	ND	1.0	ND	ND	2.0	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	1.1	ND	ND	ND	1.5	3.3	ND	ND	3.9	1.7	ND	ND	100.0
Cadmium	ND	0.069	ND	0.047	0.018	ND	4	0.057	1.0	0.048	0.32	0.010	2.6	4.0	1.9	ND	0.017	0.47	1.2	ND	0.018	ND	0.74	ND	ND	1.0	0.64	ND	3.4	3.9	ND	ND	0.10	0.011	0.045	0.012	1.0
Chromium	0.024	0.030	ND	ND	0.030	0.022	0.025	ND	ND	ND	ND	ND	ND	ND	0.028	ND	0.025	ND	ND	ND	0.027	ND	ND	0.038	0.044	ND	ND	0.030	0.13	ND	ND	ND	0.60	ND	ND	0.033	5.0
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
Lead	0.11	0.069	0.078	0.23	0.33	0.092	0.096	0.4	0.82	ND	ND	0.086	14.6	0.85	ND	ND	0.074	0.31	5.5	0.13	0.14	0.061	0.32	0.13	0.15	4.2	1.8	0.085	35.4	15.6	0.061	0.16	0.68	0.10	0.12	0.17	5.0
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0

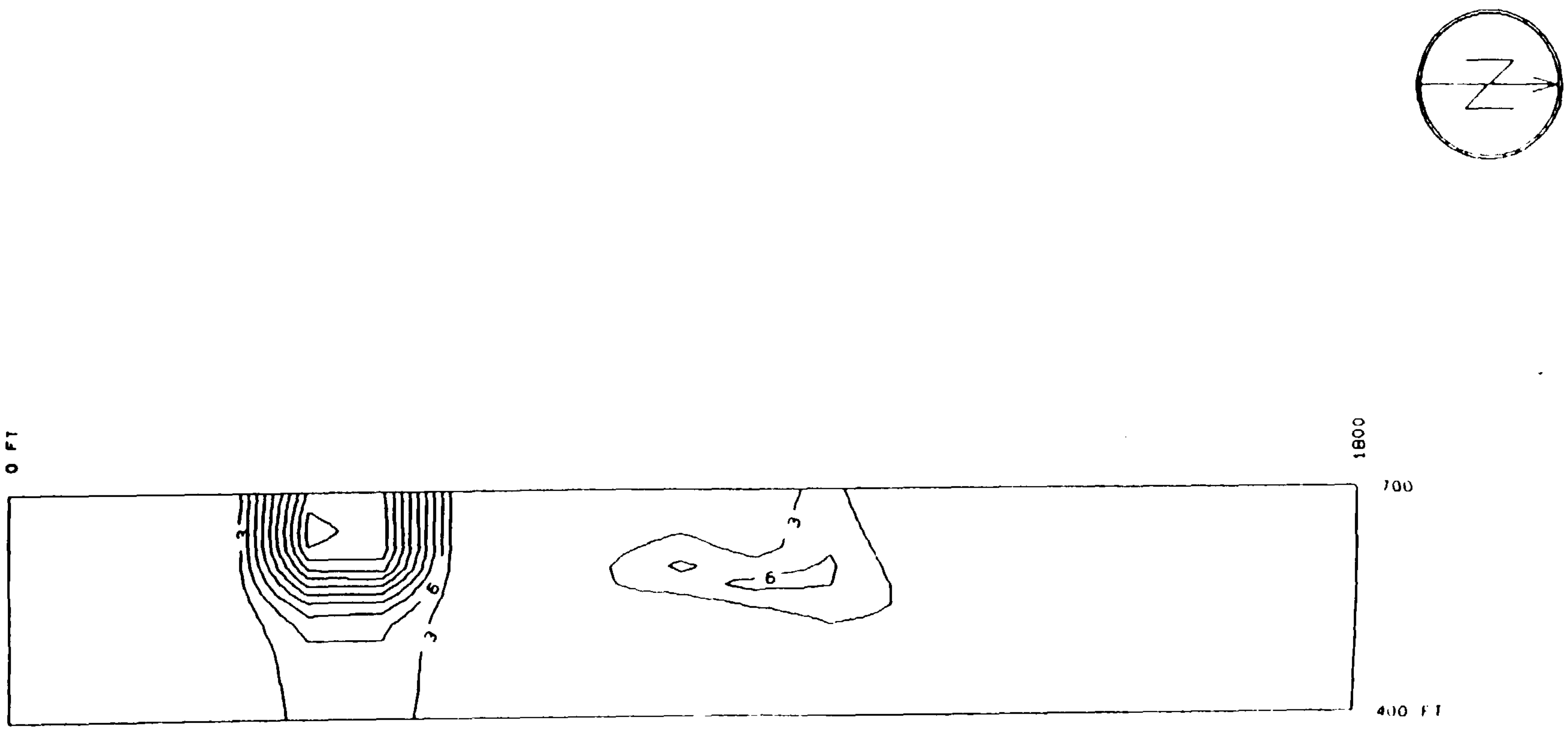
** units : mg/L **

4.3.2 EP Toxicity Pesticides and Herbicides

The EP Toxicity pesticide and herbicide analysis was performed on 29 samples collected from various borings and various boring depths (Table 3). The method for analyses for EP Toxic pesticides was performed using Method SW-846, 8080. The method used in analyzing for herbicides was SW-846, 8150. Results of the pesticide and herbicide analysis were all below the detectable limits.

4.3.3 Contour Maps - EP Tox

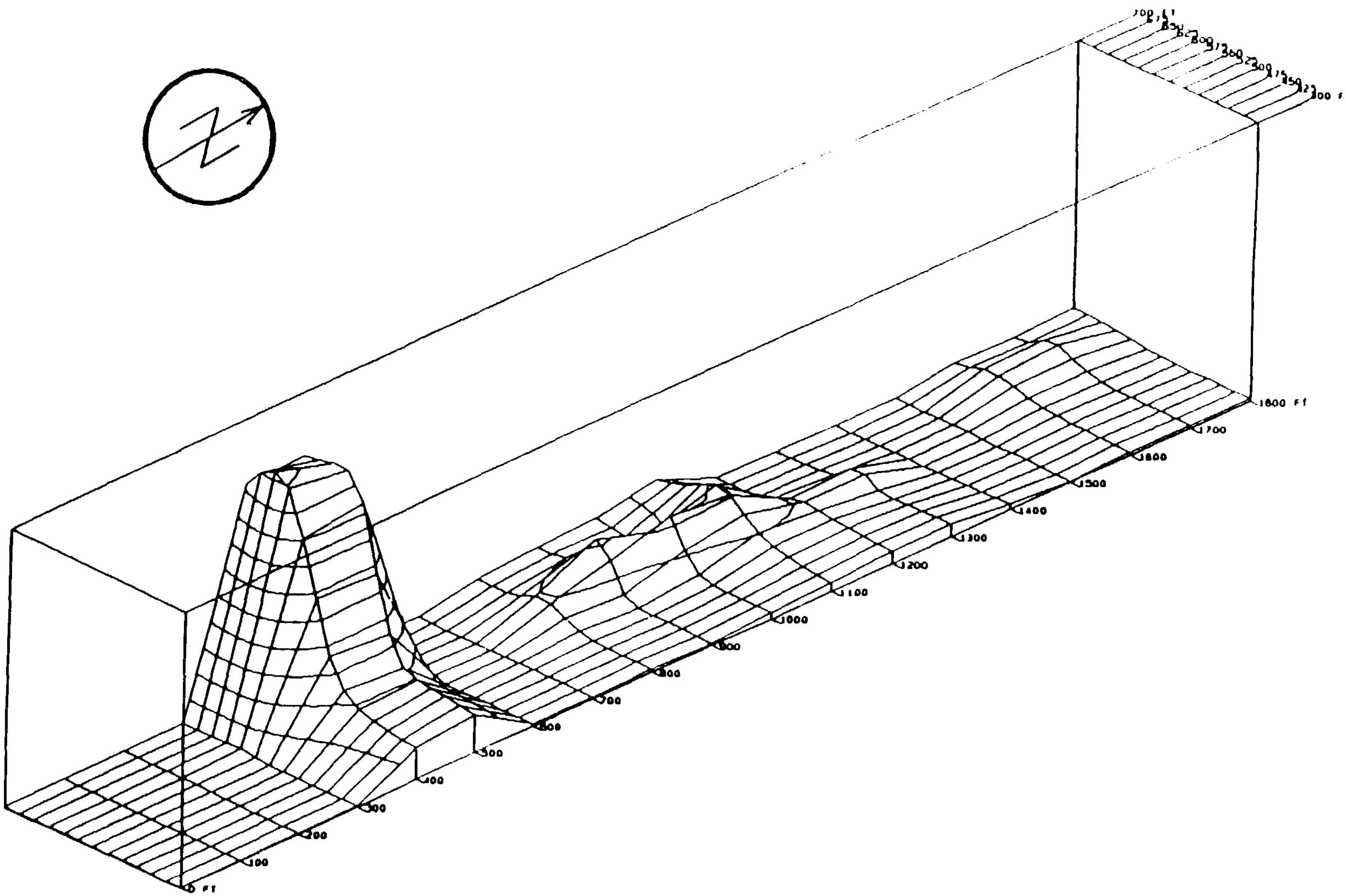
See Figures on the following pages.



CS-A
EPTOX: Lead

THE AVENDT GROUP, INC

Figure 34



CS - A
EPTOX: Lead

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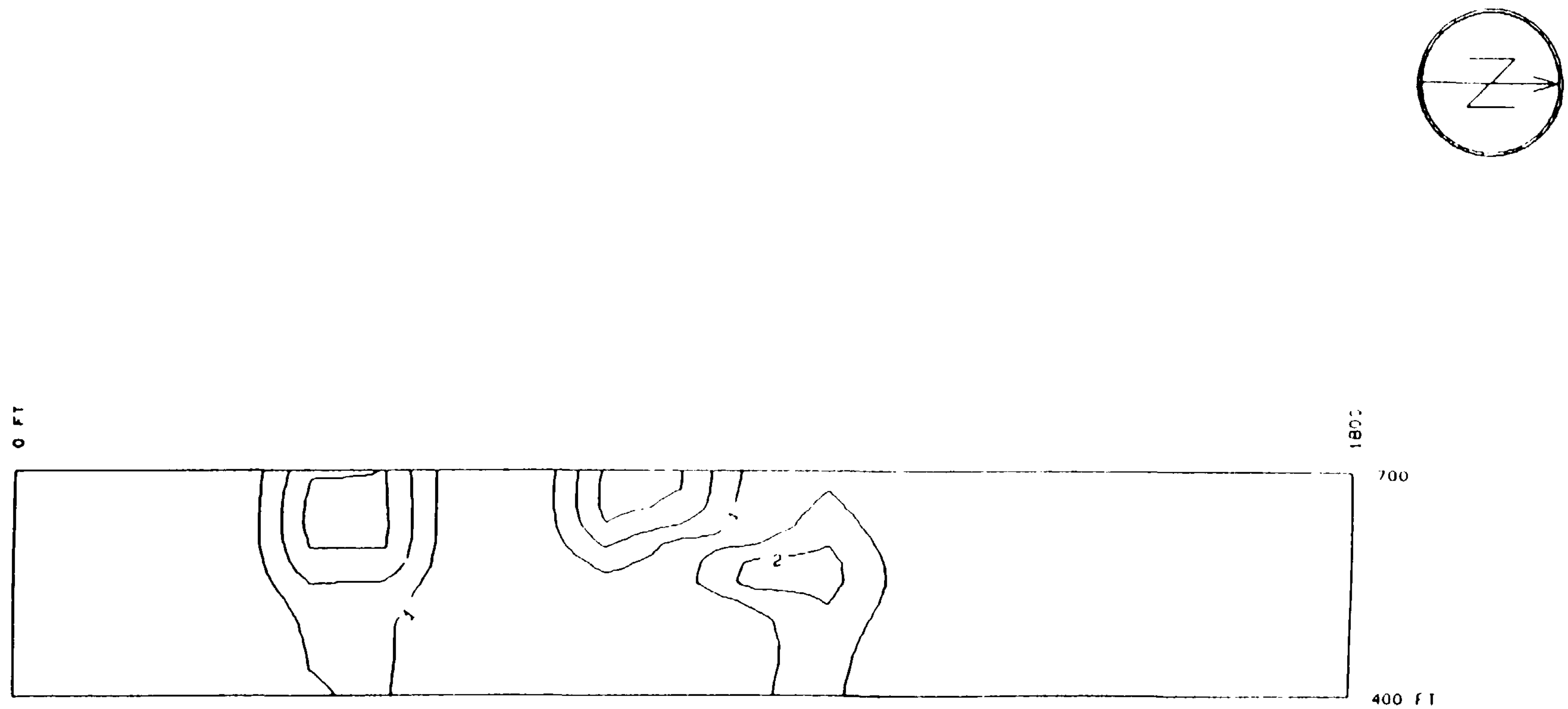
Figure 35

R1

RENUM001809



CS - A
EPTOX: Cadmium

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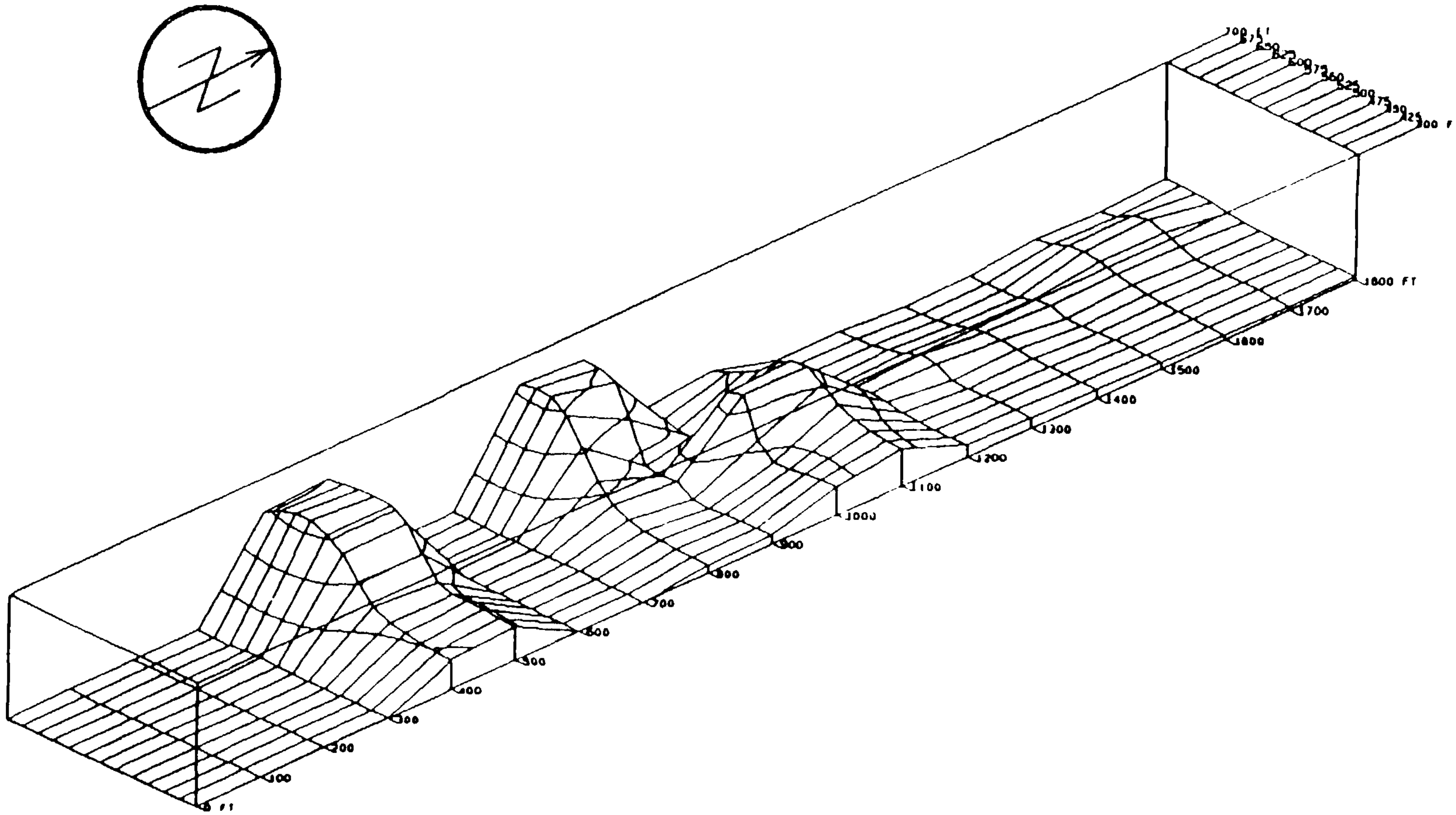
Figure 36



CS - A
EPTOX: Cadmium

X, Y, Z=1, 1, .75

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Figure 37

83

RENUM001811

4.4 Hazardous Substance List (HSL), Total Metals Analysis

4.4.1 Test Results

The method of analyses for the HSL total metals was as follows:

Mercury	SW 846 Method 7471
Arsenic	SW 846 Method 7061
Selenium	SW 846 Method 7741
All remaining metals	SW 846 ICAP Method 6010

Thirty (30) samples were characterized for HSL Total Metals concentrations (Table 3). The digestive procedure for the preparation of metals analyses was performed using SW-846, Method 3050. The metals which were quantified through this procedure are presented in Table 7, were located generally in the southern one-third to one-half of CS-A, and are graphically shown in Figures 38 - 65.

4.4.2 Table of Results

See Table 7 on the following page.

4.4.3 Contour Maps - Total Metals

See Figures on the following pages.

Table 7

CS - A

Total Metals

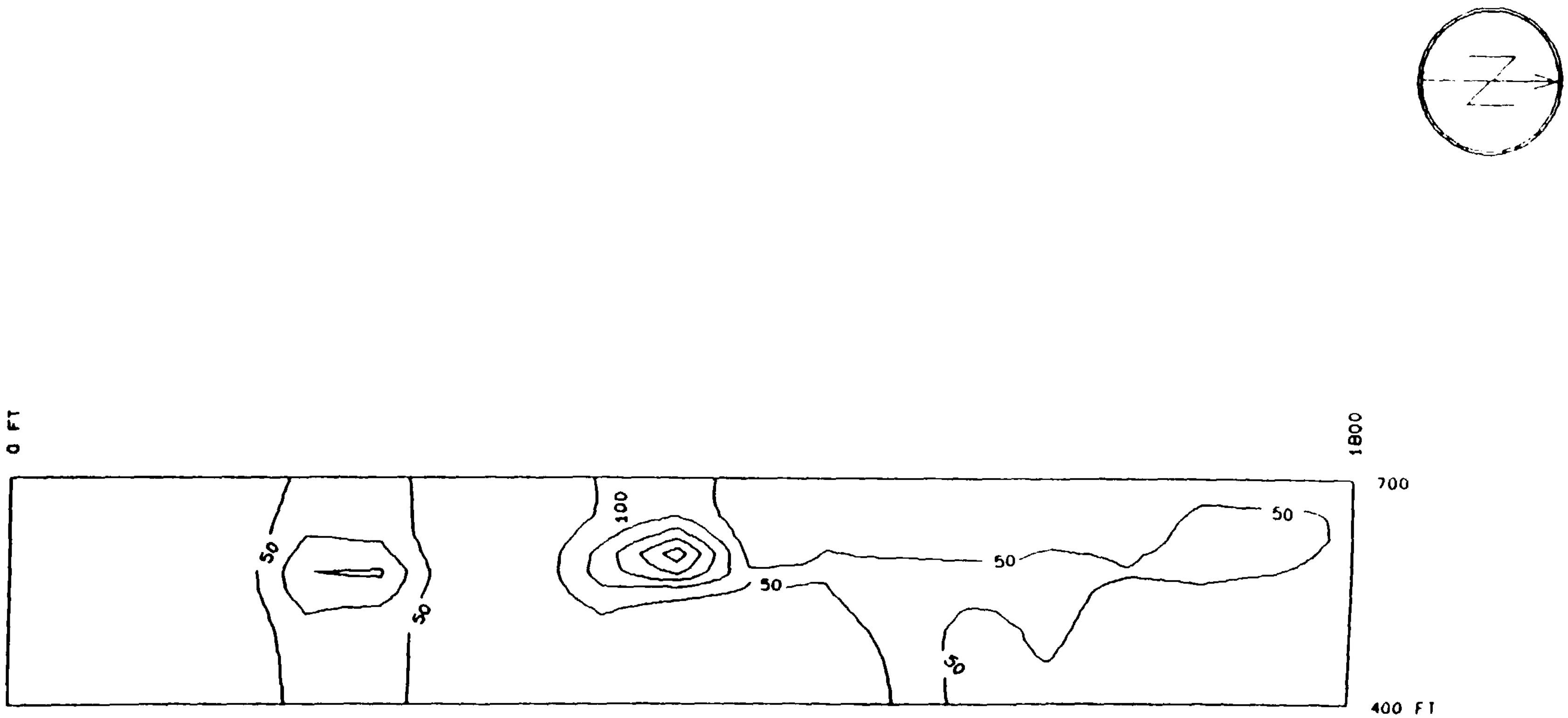
Sample	A10 15-17	A11A 8-13	A11B 4-8	A11C 2-8.5	A11D 8-10	A12A 8-11	A12B 3-7	A12C 4-9	A12D 17-20	A13B 4.5-6	A13C 4-8.5	A13D 18-23	A14A 4-9	A14B 4-8.5	A14C 4-8.5
Date:															
Parameters															
Silver	ND	ND	ND	8.6	ND	ND	328	93.0	ND	154	73.5	ND	ND	44.1	141
Aluminum	5150	7380	5870	5430	10300	8270	8050	3780	3170	5480	4350	5930	5450	3740	4970
Arsenic	3.4	13	4.7	23.1	4.4	3.9	ND	194	3.0	78.0	145	4.6	2.9	99.5	122
Barium	252	240	212	182	2450	197	516	500	244	1980	2180	219	201	5200	1560
Beryllium	ND	ND	ND	ND	ND	ND	44.1	1.9	ND	9.1	3.4	ND	ND	ND	25.2
Calcium	17700	3940	20100	8090	11700	15900	ND	5330	9130	14600	12800	15000	15700	12600	5260
Cadmium	ND	5.2	ND	4.9	ND	ND	393	47.0	ND	529	228	ND	ND	49.7	316
Cobalt	ND	ND	15.7	15.3	38.4	ND	ND	ND	ND	ND	31.4	ND	ND	23.0	ND
Chromium	10.7	222	11.7	27.2	94.2	12.6	553	695	10.0	581	452	15.4	10.8	329	402
Copper	19.9	1130	117	3330	2100	183	77700	34800	298	42800	25900	151	48.1	15800	41300
Iron	9990	13800	13800	16700	13100	12100	312000	88100	7310	118000	83100	12100	11800	78100	172000
Mercury	ND	ND	ND	3.1	3.3	ND	27	5.3	ND	17.7	2.3	ND	ND	28.7	12.8
Potassium	ND	1070	1490	1090	ND	1420	ND	ND	ND	ND	ND	1220	1250	ND	ND
Magnesium	6100	2660	6690	4130	2500	7330	ND	ND	3040	ND	ND	6400	6580	2710	ND
Manganese	236	58.0	440	197	180	150	41.6	139	101	379	305	249	173	265	183
Sodium	ND	ND	ND	ND	4540	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	27.5	303	23	301	6940	133	1530	959	47.7	1420	2230	27.4	27.7	1220	1240
Lead	10.8	72.0	12.9	278	710	7.8	32400	2380	29.7	15700	4180	30.2	13.6	1040	23800
Antimony	ND	ND	ND	ND	ND	ND	356	88.1	ND	98.0	48.0	ND	ND	22.8	175
Selenium	ND	ND	1.3	1.0	0.60	2.5	38.9	28.8	ND	ND	ND	ND	ND	1.2	ND
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	10.5	21.0	19.4	17.0	33.5	19.4	ND	27.4	12.9	41.5	35.4	19.4	17.4	34.8	ND
Zinc	82.5	1410	68.5	1200	655	333	26800	4020	172	21300	11500	209	69.8	6080	15000

Sample	A14C 8.5-10	A14D 10-14	A15B 6-9	A15B 13-16	A15C 4.5-9	A15D 4-9	A16B 9-12	A16C 2-5	A21B 1-6	A21C 4-8	A21D 14-19	A22B 0-7	A22C 3-9	A23A 19-20
Date:														
Parameters														
Silver	ND	ND	ND	ND	63.8	ND	55.8	91.9	132	348	ND	2.4	11.9	ND
Aluminum	7200	4550	7180	1520	4540	4980	1980	1400	2800	5120	4550	3110	2970	5590
Arsenic	7.6	5.5	11.9	2.4	105	6.4	10.8	7.5	7.6	25.3	ND	6.9	18.5	5.6
Barium	250	191	242	57.9	2180	170	712	473	529	1050	148	241	414	198
Beryllium	ND	ND	1.6	ND	21.8	ND	3.1	2.5	2.9	36.0	ND	ND	ND	ND
Calcium	22700	14500	21900	6270	7350	13500	9030	7270	17000	12100	12600	12700	12000	26200
Cadmium	2.7	ND	7.3	ND	532	ND	52.5	49.4	135	470	ND	2.6	29.7	ND
Cobalt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23.0
Chromium	17.0	9.8	22.9	4.9	333	11.3	128	119	434	397	12.4	28.7	62.0	15.6
Copper	338	41.4	722	28.4	17800	25.0	26000	16600	29400	91800	24.7	1160	3510	591
Iron	19800	11200	21200	4240	254000	10600	52300	69900	45700	199000	11300	10100	12600	13500
Mercury	0.16	ND	ND	ND	61.2	ND	124	93.0	8.2	18.3	ND	0.17	ND	ND
Potassium	1720	ND	1630	ND	ND	1060	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	5980	5180	5880	2100	ND	5350	1560	ND	1600	ND	4320	4220	2740	5160
Manganese	871	351	622	116	230	379	47.7	40.1	228	235	167	194	133	318
Sodium	ND	ND	ND	ND	ND	ND	1310	ND	ND	ND	ND	ND	ND	ND
Nickel	47.7	14.2	73.4	ND	1820	15.0	705	716	562	6410	47.7	95.2	317	56.3
Lead	88.5	10.6	250	ND	5860	9.5	3760	2910	10000	30400	12.9	145	749	24.0
Antimony	ND	ND	ND	ND	138	ND	117	114	51.8	305	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND	10.9	5.3	8.8	41.6	ND	0.73	2.0	ND
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	25.0	15.9	24.8	ND	43.0	15.2	ND	ND	ND	ND	20.3	10.3	11.9	17.4
Zinc	187	47.9	337	28.1	13700	52.1	2290	2120	9300	26700	270	373	1510	237

Units: mg/kg
ppm

* No value found in natural soils

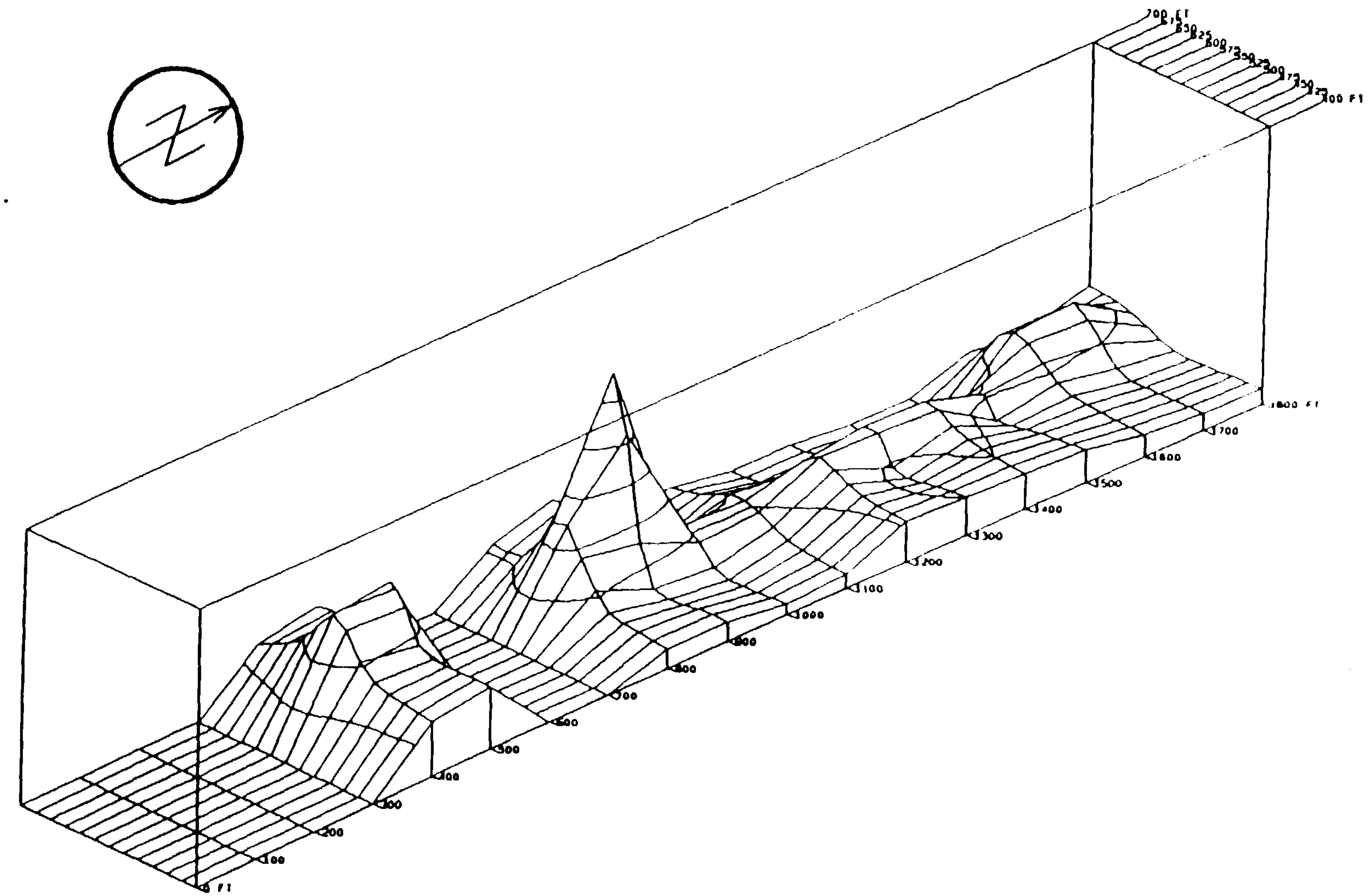
RENUM001813



CS - A
Antimony Concentrations

THE AVENDT GROUP, INC.

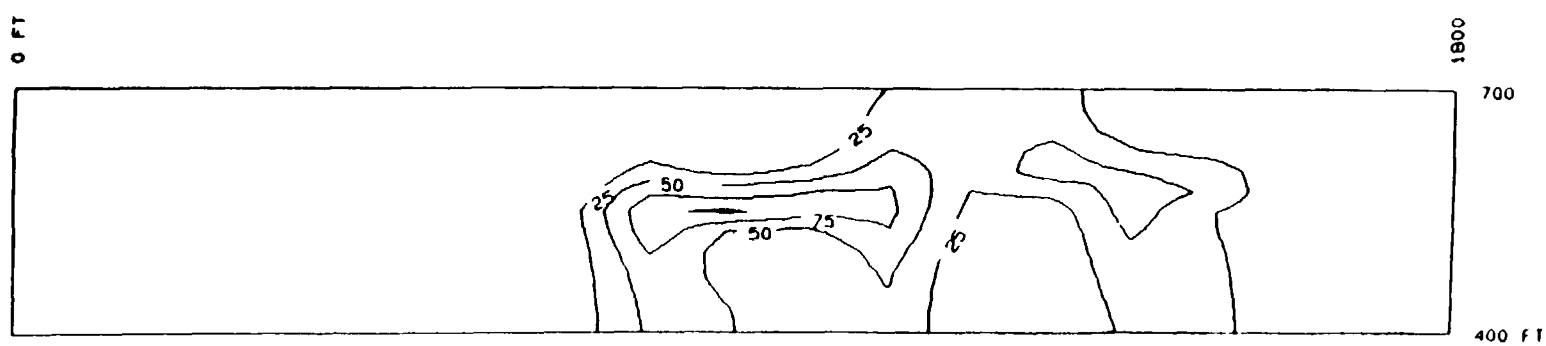
Figure 38



CS - A
Antimony Concentrations

THE AVENDT GROUP, INC

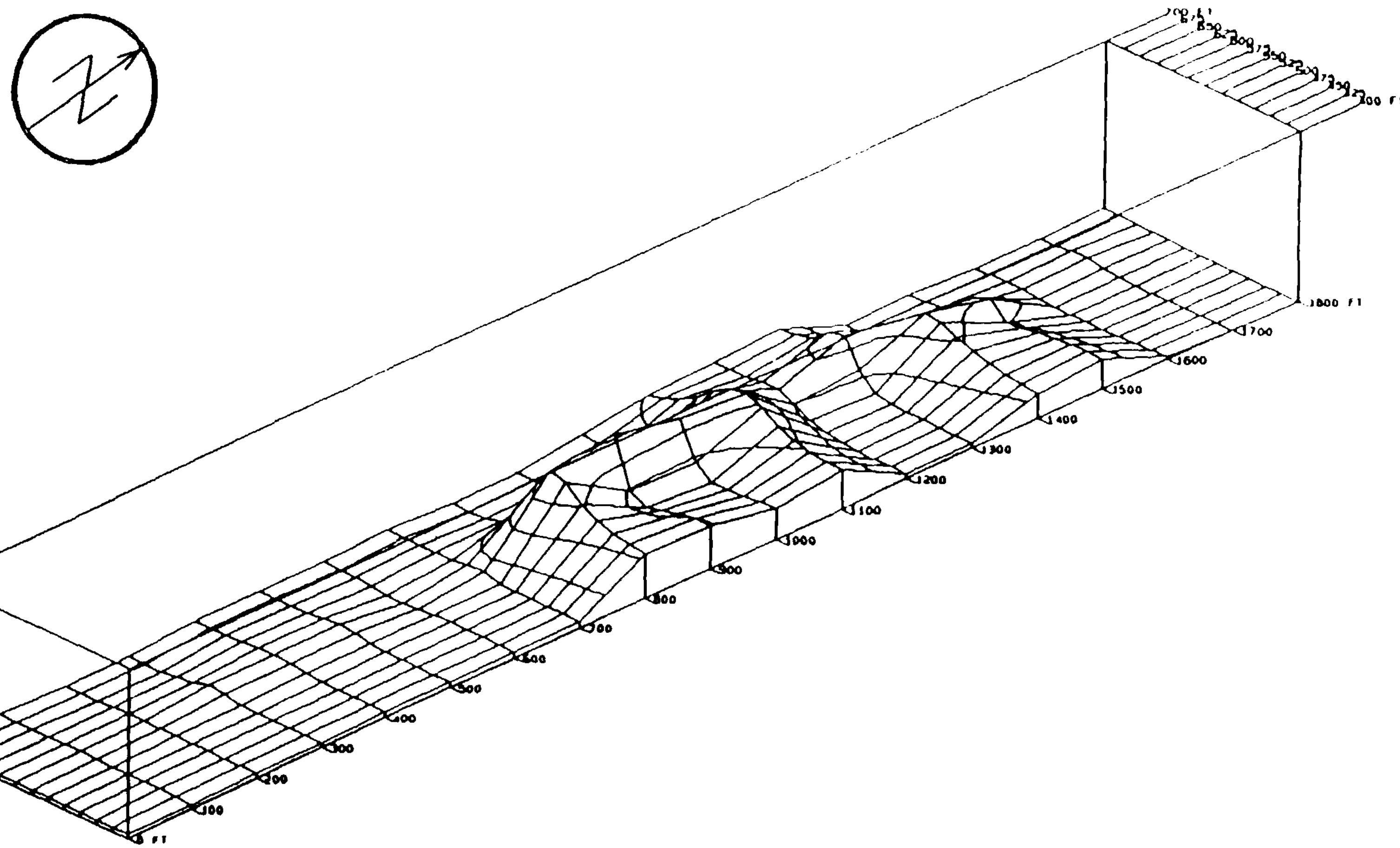
Figure 39



CS - A
Arsenic Concentrations

THE AVENDT GROUP, INC

Figure 40

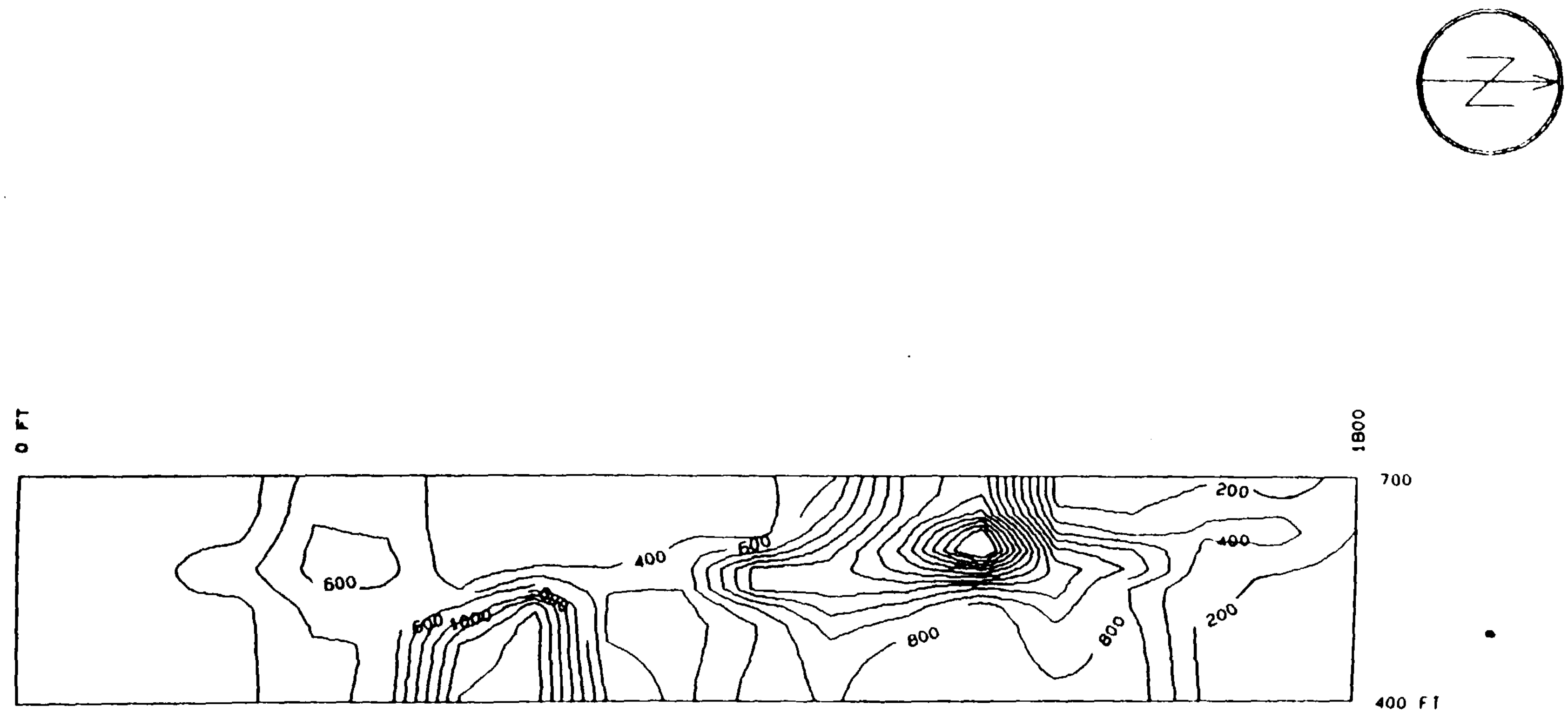


CS - A
Arsenic Concentrations

THE AVENDT GROUP, INC

Figure 41

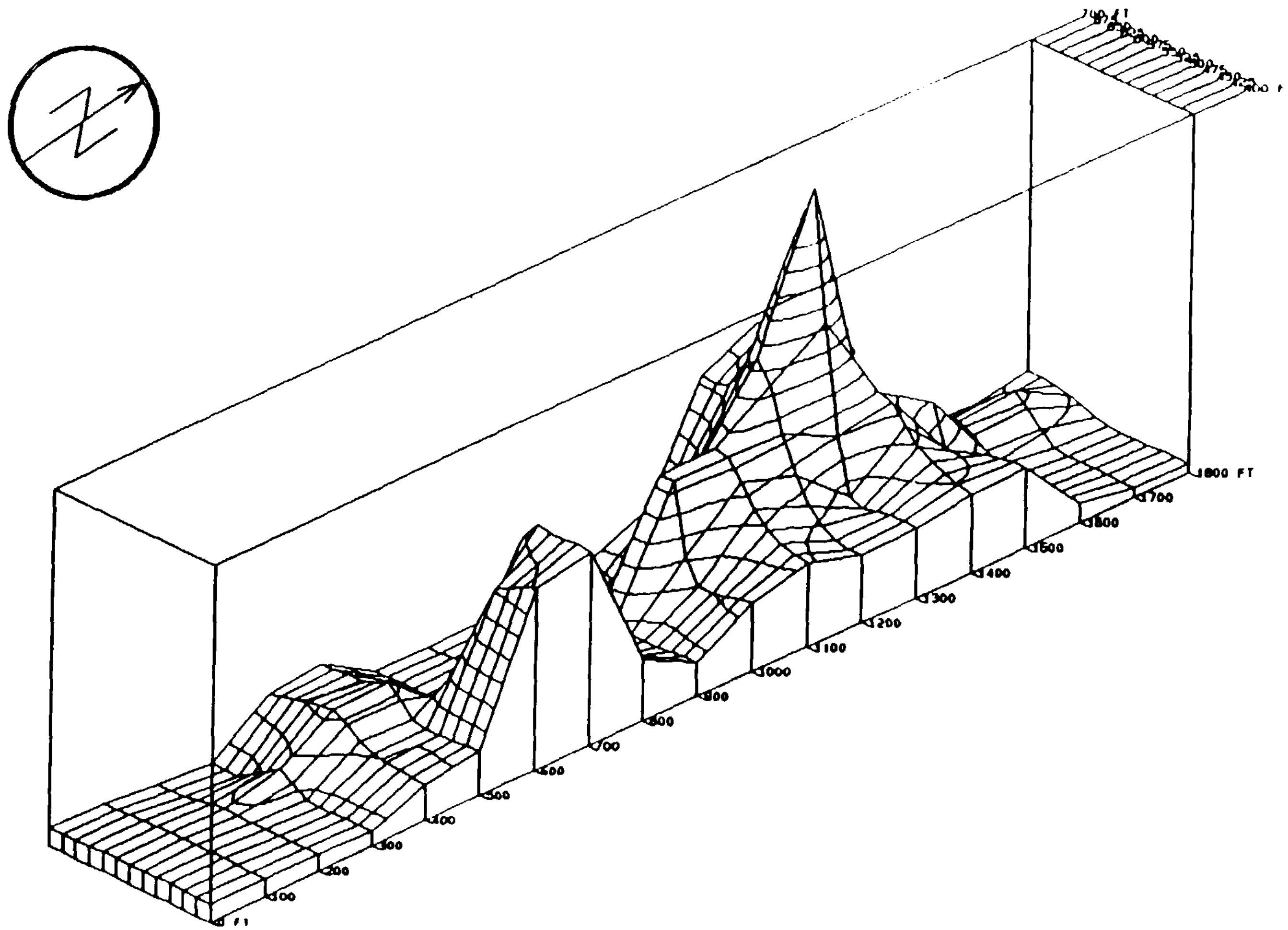
RENUM001818 90



CS - A
Barium Concentrations

THE AVENDT GROUP, INC.

Figure 42

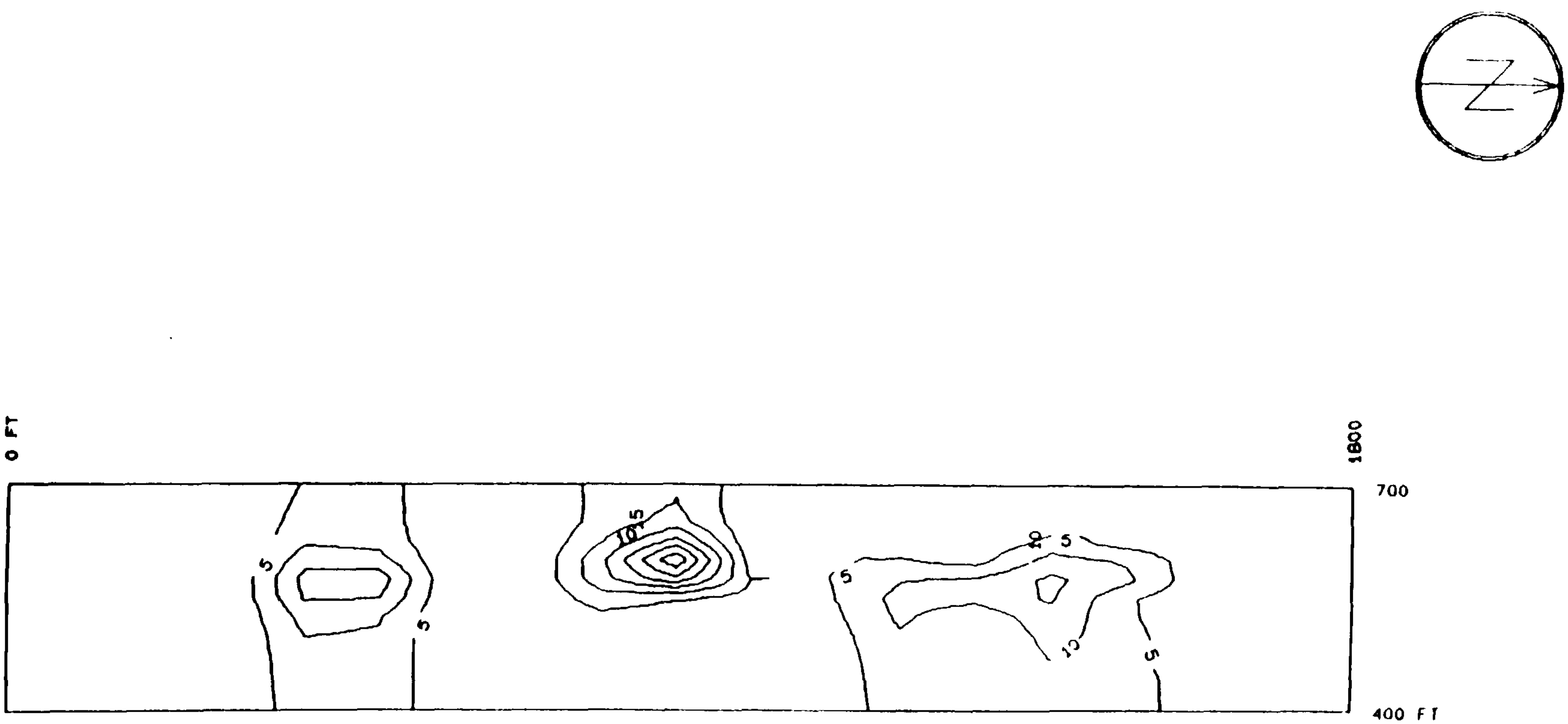


CS - A
Barium Concentrations

X, Y, Z=1.75, 1.75, .5

THE AVENDT GROUP, INC.

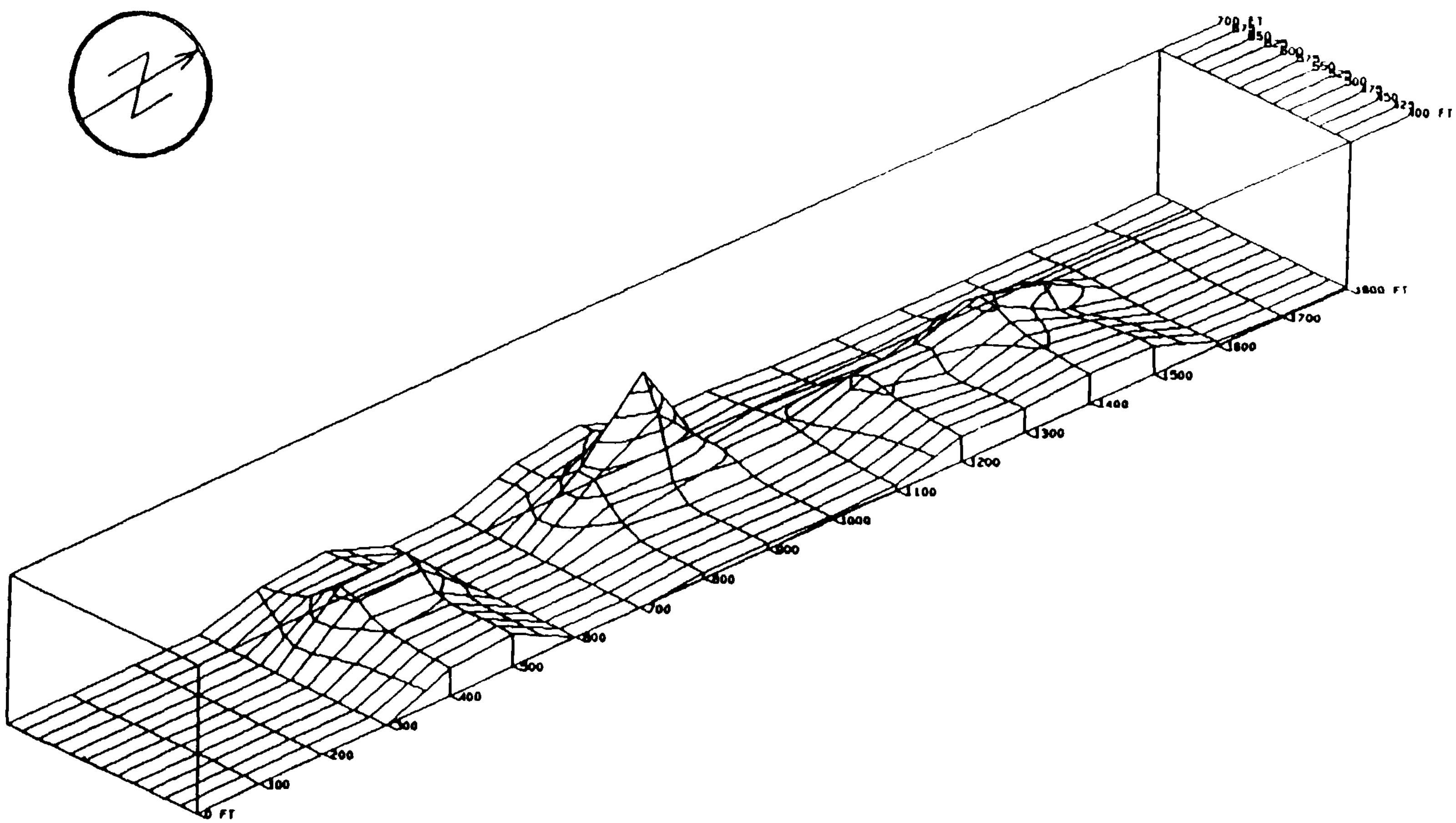
Figure 43



CS - A
Beryllium Concentrations

THE AVENDT GROUP, INC.

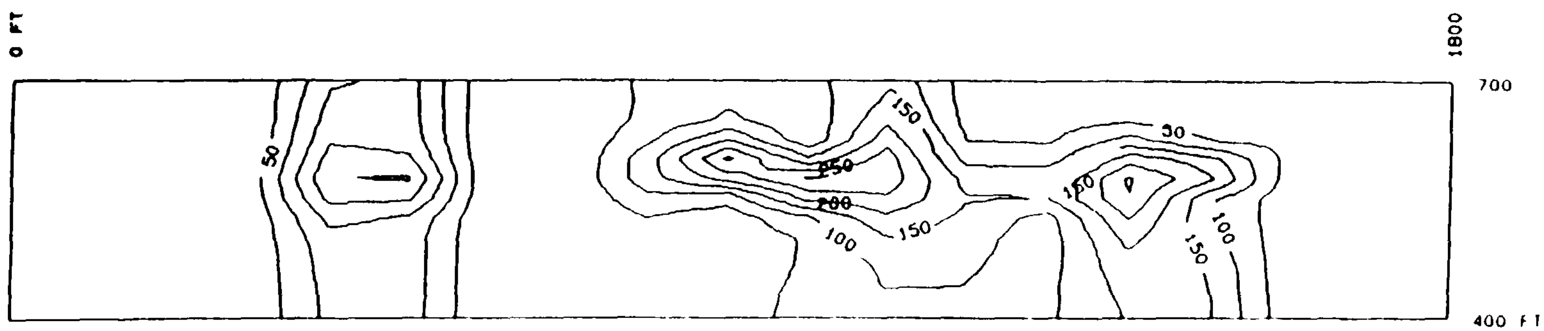
Figure 44



CS - A
Beryllium Concentrations

THE AVENDT GROUP, INC.

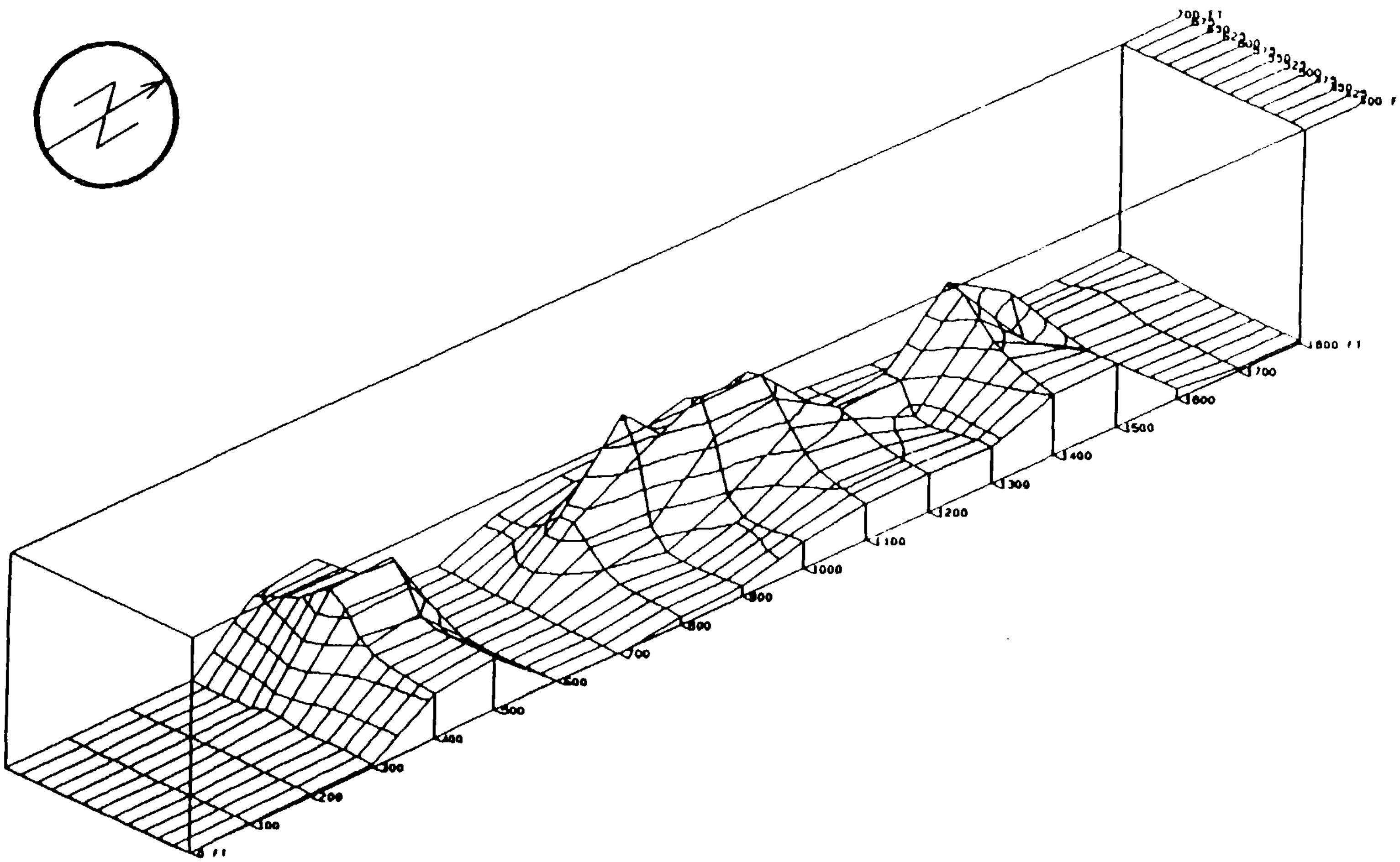
Figure 45



CS - A
Cadmium Concentrations

THE AVENDT GROUP, INC

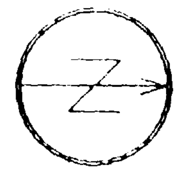
Figure 46

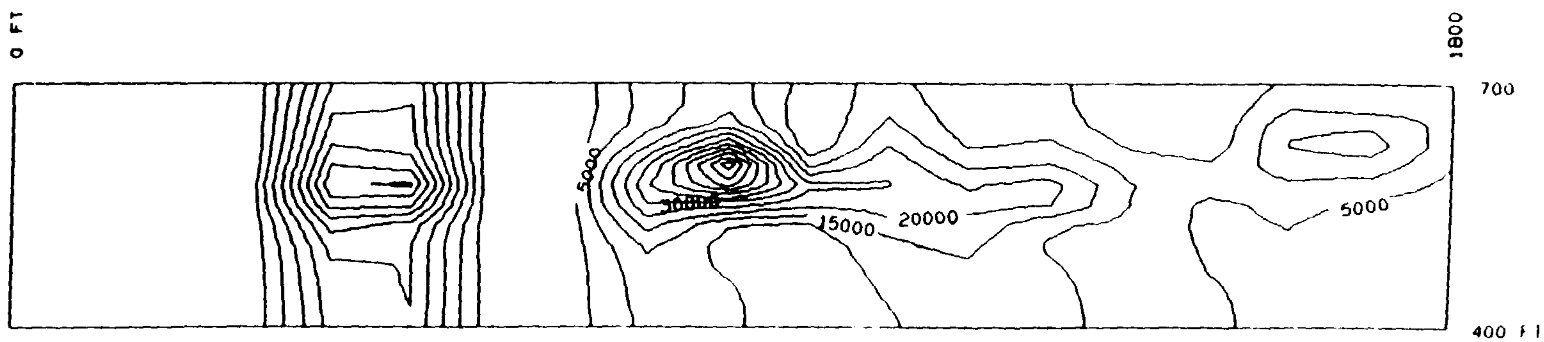


CS - A
Cadmium Concentrations

THE AVENDT GROUP, INC

Figure 47





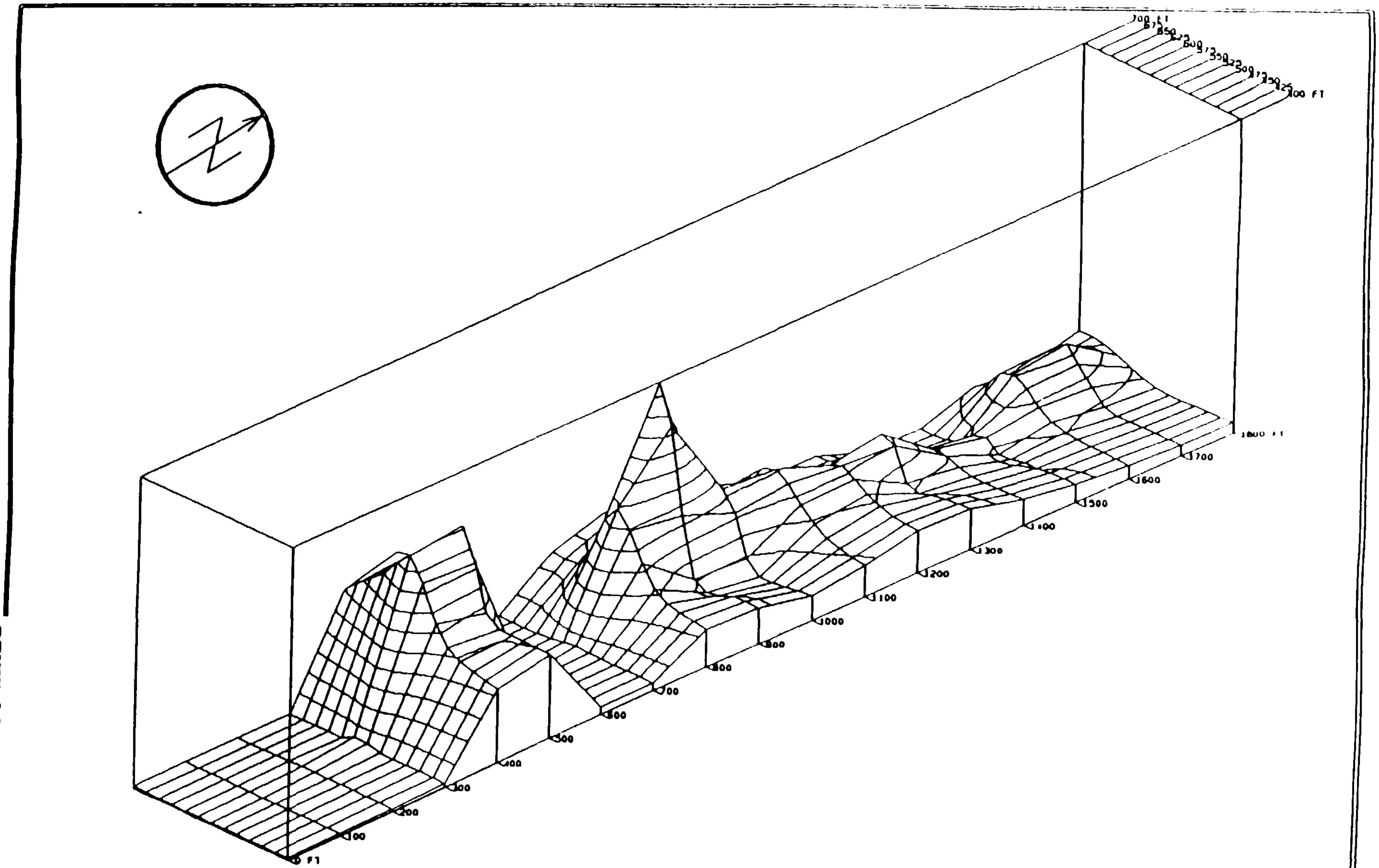
CS - A
Copper Concentrations

THE AVENDT GROUP, INC.

Figure 48

96

RENUM001824

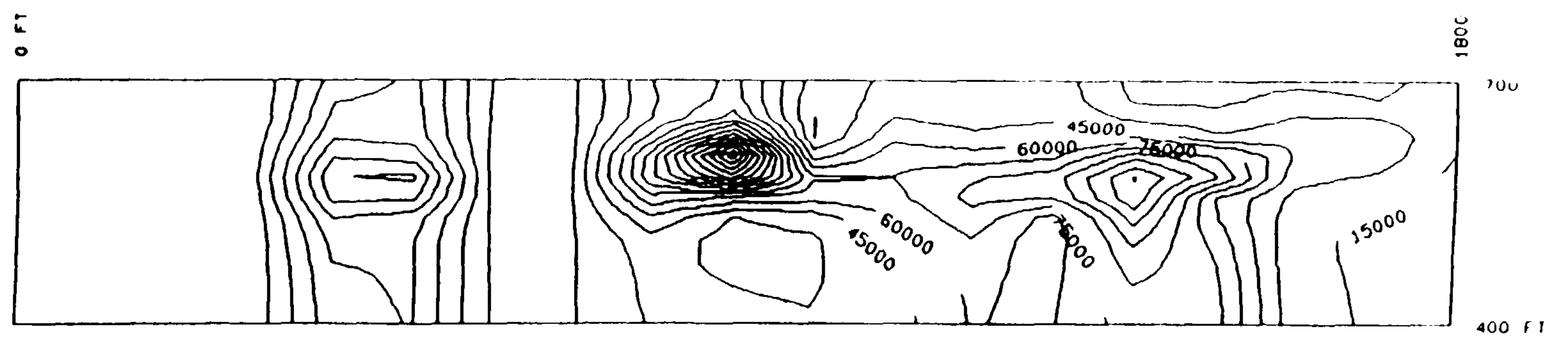


CS - A
Copper Concentrations

X, Y, Z=50, 50, .5

THE AVENDT GROUP, INC.

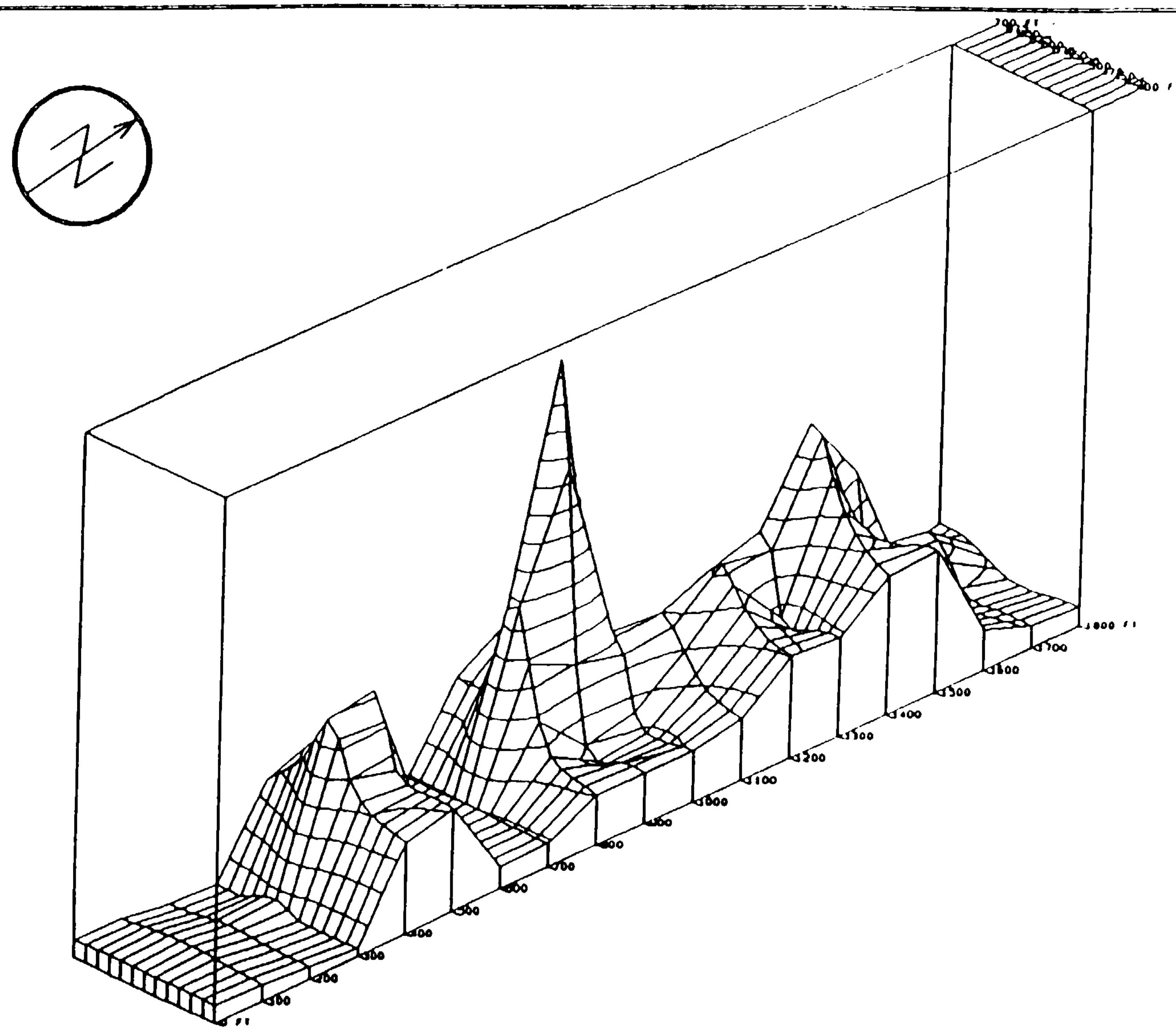
Figure 49



CS - A
Iron Concentrations

THE AVENDT GROUP, INC.

Figure 50

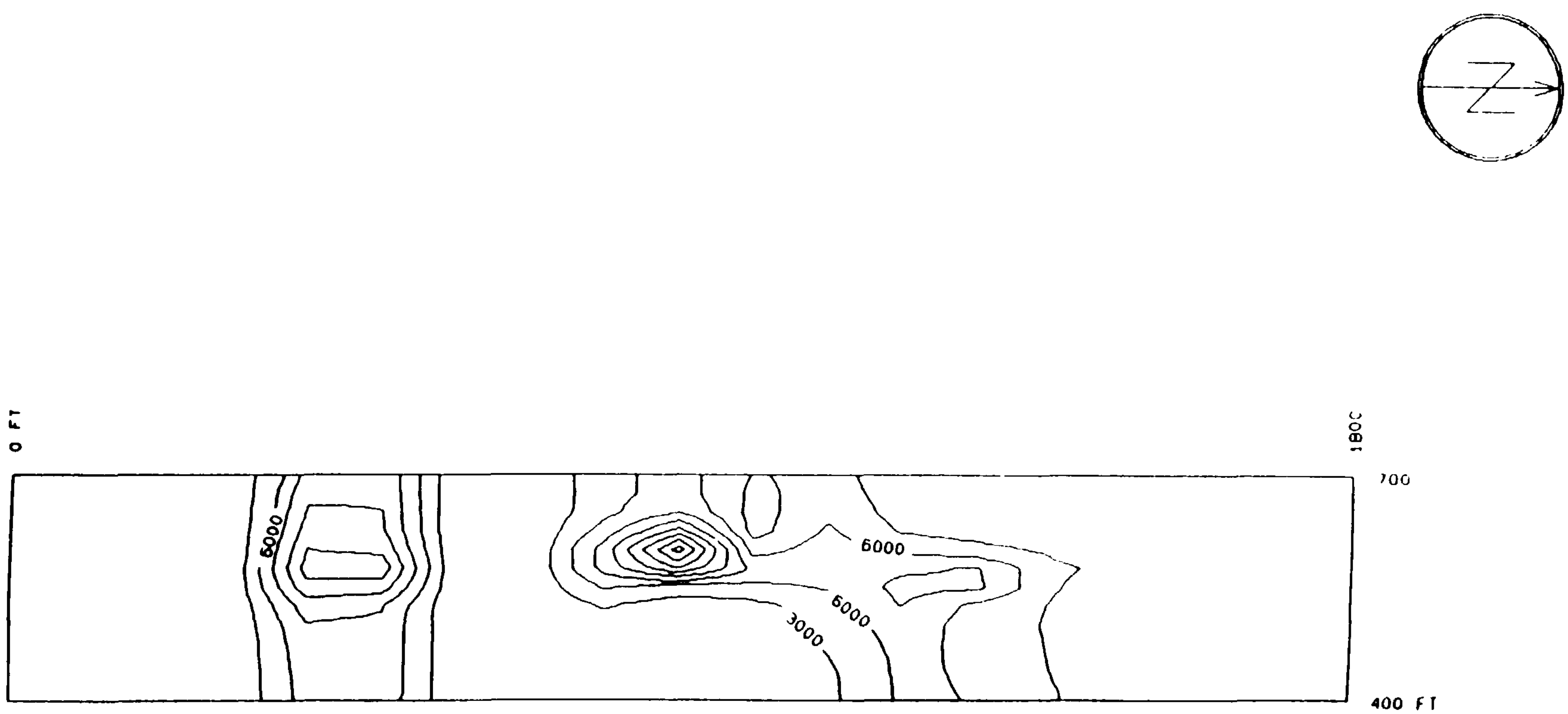


CS - A
Iron Concentrations

X, Y, Z=330, 330, .7

THE AVENDT GROUP, INC.

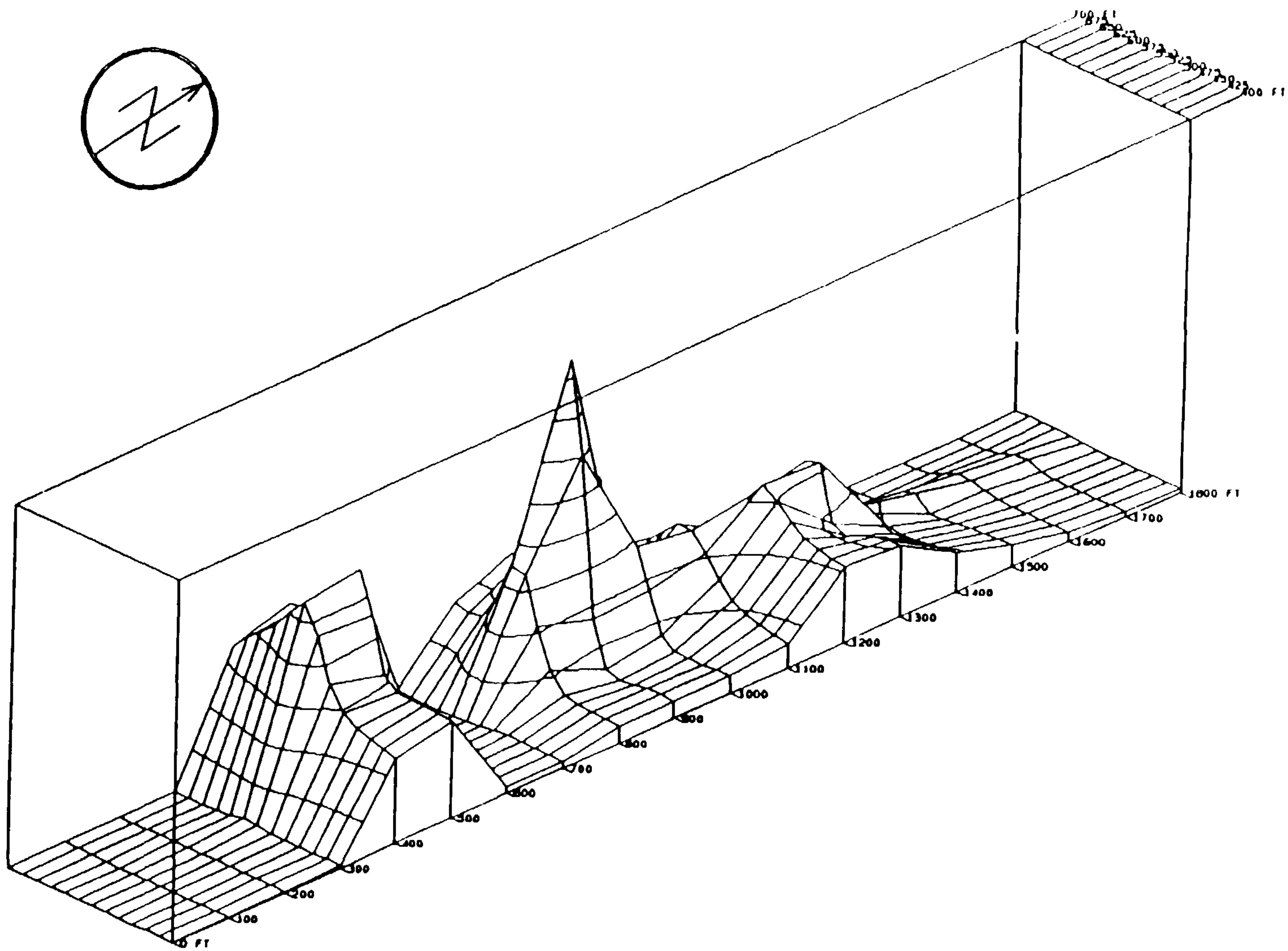
Figure 51



CS - A
Lead Concentrations

THE AVENDT GROUP, INC.

Figure 52



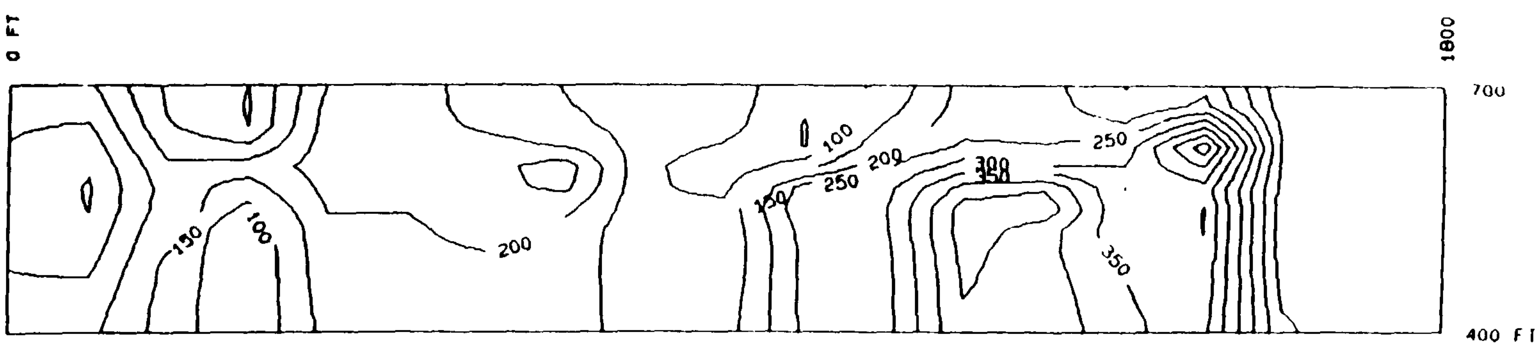
CS - A Lead Concentrations	X Y Z=15 15 .5

THE AVENDT GROUP, INC

Figure 53

RENUM001829

101

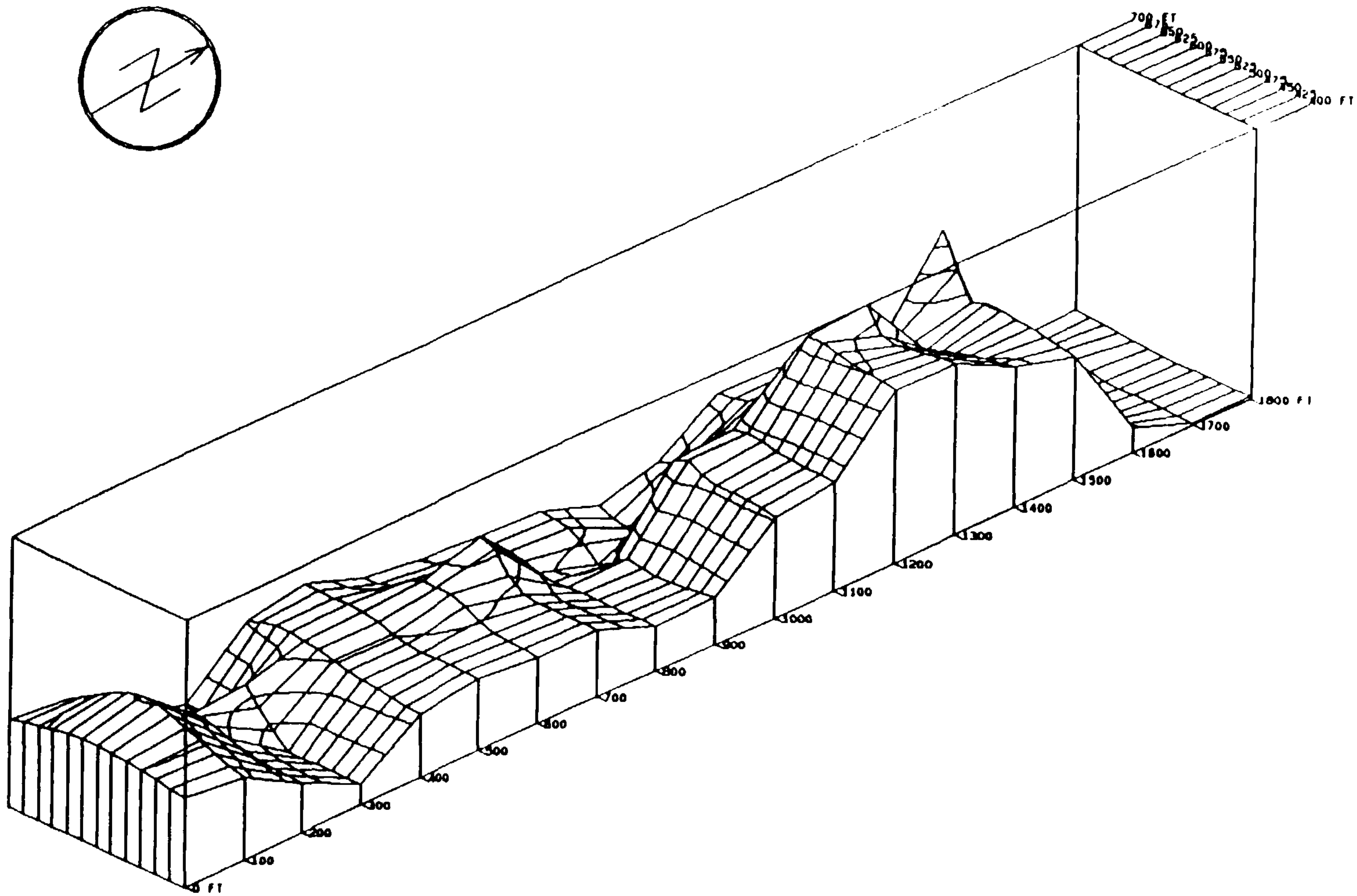


CS - A
Manganese Concentrations

THE AVENDT GROUP, INC.

Figure 56

RENUM001830



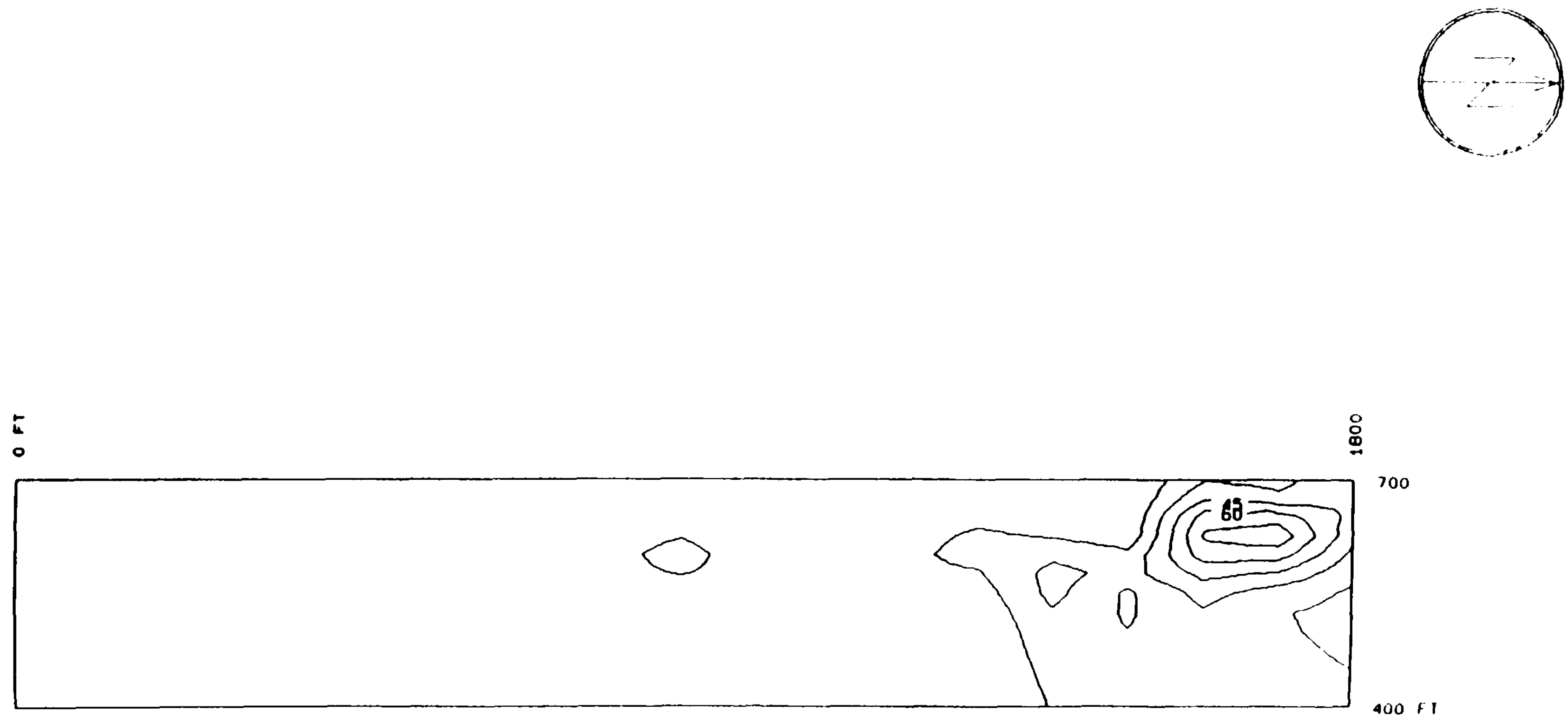
CS - A
Manganese Concentrations

X Y Z=3. 1. 1

THE AVENDT GROUP, INC.

Figure 55

RENUM001831



CS - A
Mercury Concentrations

THE AVENDT GROUP, INC

Figure 56

QA/QC Precaution

To maintain quality assurance and quality control measures, all boring equipment (i.e., augers, drilling rods, etc.) should be steam-cleaned after an acetone rinse between borings. Avendt Group personnel will observe the decontamination operation. All dirt and materials must be removed from the auger flights. All rinse and waste water during the boring activities should be disposed per state and federal regulations.* Also to monitor possible contamination, a trip blank prepared from distilled deionized water should be carried throughout the sampling, storage and shipment process. Sample pouring and collection near to exhaust fumes must be avoided.

***Disposal of On-site Generated Waste**

All small amounts of decontamination and rinse solutions must be stored in 55-gallon drums. Larger drums of 110 gallons, 1,000 gallons, etc., will be employed according to the volume of waste rinse solution generated. These could be either associated with personal contamination station or large equipment rinse that must be done in an area that will collect all the spent fluids. The waste rinse containers that can be sealed until ultimate disposal is arranged.

Decontamination and rinse solutions cannot be allowed to drain back on site.

Proper labeling is required on each decontamination rinse solution drums and mud pits. The maximum duration for storing the on-site generated waste is 90 days. Beyond this period, permit and interim status will be required. Details of applicable waste storage, management and disposal of contaminated materials is an RCRA requirement and is found in 40CFR262 entitled "Standard Applicable to Generators of Hazardous Wastes."

IEPA will be contacted at (217) 782-3397 for the applicable state requirements when such a condition arises.

<u>Equipment Check List, Level C:</u>

Ultra-Twin Respirator: ____________
Racal power air purifier: ____________
Racal cartridge (type GMC-H
AEP-3) HEPA filters: ____________
Robert Shaw escape mask: ____________
Chemical-resistant coveralls: ____________

Protective coveralls: ____________
Type Saranac hooded: ____________
Rain suits: ____________
Butyl apron: ____________
Gloves (type viton-neoprene): ____________
Outer work gloves: ____________
Neoprene safety boots: ____________
Hard hat with face shield: ____________
Hard hat without face shield: ____________
Latex disposable booties: ____________
Safety glasses: ____________

Decon Equipment Check List:

Wash tubs: ____________
Buckets: ____________
Scrub brushes: ____________
Pressurized sprayer: ____________
Detergent (type tsp Alconex): ____________
Solvent (type, acetone): ____________
Plastic sheets: ____________
Tarps: ____________
Trash bags: ____________
Trash cans: ____________
Masking tape: ____________
Duct tape: ____________
Paper towels: ____________
Face mask: ____________
Face mask sanitizer: ____________
Folding chairs: ____________
Step ladder: ____________

First-Aid Equipment Check List:

First-aid kit: ____________
Oxygen administrator: ____________
Stretcher: ____________
Portable eye wash: ____________
Blood pressure monitor: ____________
Radiation badges: ____________
Fire extinguisher: ____________
Thermometers (oval): ____________
Walkie-talkie: ____________

Van Equipment Checklist:

Tool kit:	________
Hydraulic jack:	________
Gas:	________
Oil:	________
Anti-freeze/coolant:	________
Battery:	________
Windshield wash:	________
Tire pressure:	________
Lug wrench:	________
Tow chain:	________
Van checkout:	________

Instrument Check List:

OVA:	________
Thermal desorber:	________
O_2/explosimeter:	________
Explosimeter calibration kit:	________
HNu W/10-2 EV lamp:	________
RAD mini:	________
Magnetometer:	________
Pipe locator:	________
Weather station:	________
Drager pump:	________
Brunton compass:	________
HNu calibration kit:	________
Monitox CN meter:	________
GCA/MDA particulate monitor:	________

Miscellaneous Check List:

Pitcher pump:	________
Surveyor's tape:	________
100' fiberglass tape:	________
300' nylon rope:	________
Nylon string:	________
Surveying flags:	________
Film:	________
Wheelbarrow:	________
Bung wrench:	________
Soil auger:	________
Pick:	________
Shovel:	________
Catalytic heater:	________
Propane gas:	________
Banner tape:	________

Surveying meter stick:	__________
Chaining pins and ring:	__________
Tables:	__________
Weather radio:	__________
Binoculars:	__________
Megaphone:	__________

Emergency Information

Since there has been background information regarding both volatile and semivolatile organics in the site, the following emergency precautions should be adopted:

	In Case of This (Acute Exposure Symptoms)	Do This (First Aid)
1)	Severe irritation of skin -	Wash irritated areas.
2)	Severe irritation of respiratory system -	Get medical aid.
3)	Accidental ingestion of unknown liquid -	Immediately induce vomiting.
4)	Dust/vapor/liquid contact irritation -	Wash affected areas with suspected and contaminant and skin in soap and water.

Site Resources:

Water Supply: 5-gallon collapsible containers will be used.

Telephone: **New Queeny Avenue and Falling Spring Road. Also Route 3 via Cerro Plant Road, and Monsanto Avenue.**

Radio: **TBA**

Other: **TBA**

Emergency Contacts:

Chris Bade, Regional Safety Coordinator,
(301) 261-1177 office, (313) 658-2048, Home.

MEDTOX Hotline: In case of emergencies that require hotline action:

1) The following should be contacted: Drs. Raymond Harbison, Glenn Milner or Robert James at (501) 370-8263 (24-hour answering services).

2) What to state:

   a) "This is an emergency;"
   b) Your name, region and site;
   c) Telephone number to reach you;
   d) Location of emergency;
   e) Name of person injured or exposed;
   f) Nature of emergency; and
   g) Action taken.

Special Site Precaution:

1) Before any boring is attempted, local utility and surrounding industries (chemical or others) should be contacted to identify (if any) their subsurface transmission lines, cables or pipes. (These have been confirmed.)

2) Care should be taken to minimize stressful conditions resulting from extreme temperatures. Heat and cold stress symptoms should/will be monitored and recorded in the site security log book.

3) Attempts to open drums of unknown contents must be avoided. This is important as to eliminate such explosion hazards.

4) Work will be conducted during daylight hours only.

5) Pre-employment and post-employment physicals are recommended for all personnel to be involved with the on-site job. The physicals must be completed a few days prior to start of work, and upon termination of work. Exposure logs will be maintained as to supplement facts on the subsequent medical checkups.

Site/Waste Characterization:

Waste type(s): Liquid, solid, sludge, corrosive, ignitable, volatile, toxic, reactive, and unknowns have been characterized and associated with the Site I/Creek Sector A subsurface soil samples.

Some specific waste types:

1) Volatile organics to a total of 10 (ten) with chlorobenzene as highest.

2) Total of 25 semivolatile organic chemicals. Those in high concentrations are:

a) 1,2,4-trichlorobenzene @ 8,300ppm
b) Hexachlorobenzene @ 1,300ppm
c) 1,4-dichlorobenzene @ 1,800ppm
d) Naphthalene @ 10ppm

Also found were fluoroethene, anthracene, dichlorobenzene, n-nitrosodiphenylamine, etc.

Pesticides/PCBs: Three pesticides and PCBs at the following levels were found:

1) 4,4'DDD @ a concentration of 30ppm
2) 4,4'DDT @ a concentration of 4.3ppm
3) Toxaphene @ a concentration of 490ppm
4) One PCB congener (i.e., arochlor)

Inorganics: Found at high concentrations were chromium, mercury, cyanide, nickel, lead, vanadium and antimony.

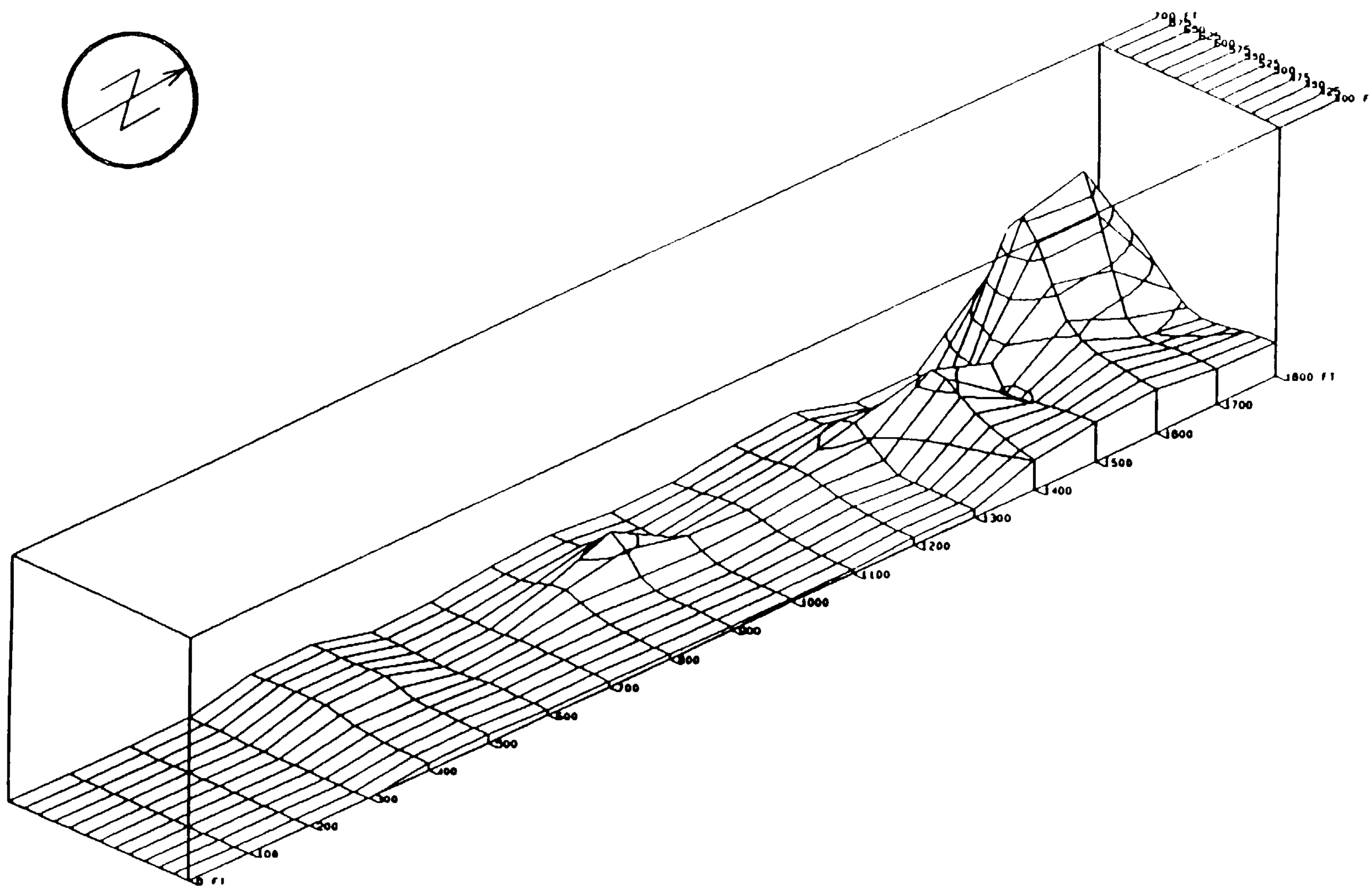
Principal Disposal Method: Landfill (area filling), wastepiles, surface impoundments, and open drumming.

- Type and location:

  1) Two disposal pits were identified at Site I, Section CS-A containing waste materials such as oily sand, clay, wood and cinders. Occasional refuse such as cardboard, rubber and cloth were identified.

  2) At Sector B, rubbery wastes and sponge-like materials were found on surface soils. Stagnate water at surface depressions and shallow channels were evidenced at northern half of CSB.

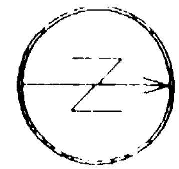
Past investigations detected contaminants in the following media: soils, groundwater, surface water, sediments and air. Primary source of contamination is the soil from waste disposal.

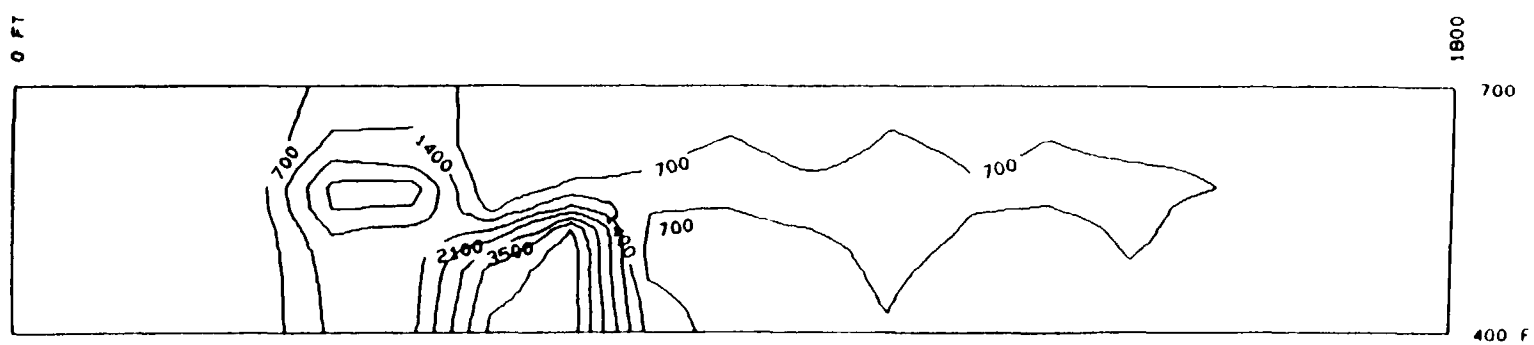


CS - A
Mercury Concentrations

THE AVENDT GROUP, INC

Figure 57

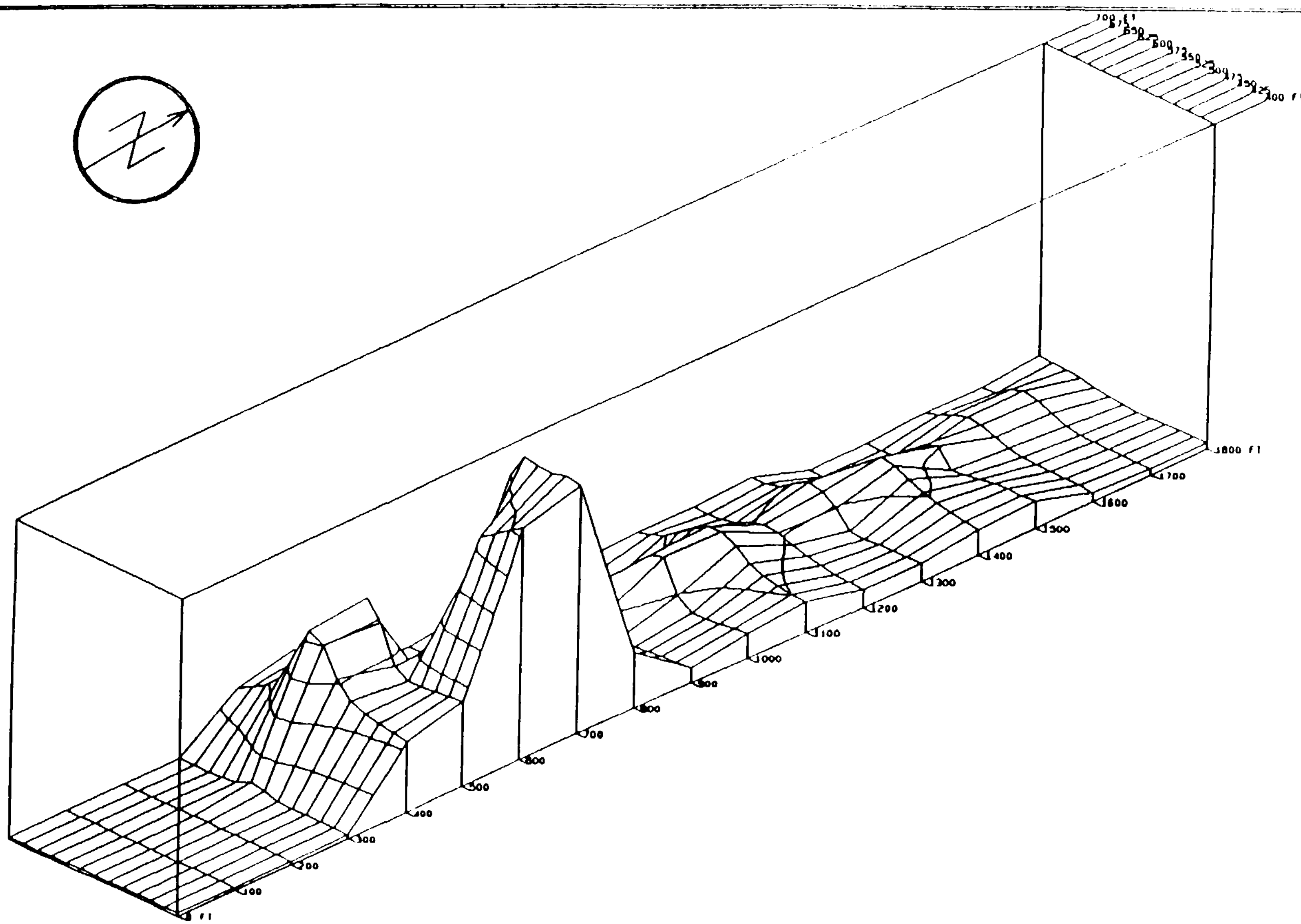




CS - A
Nickel Concentrations

THE AVENDT GROUP, INC

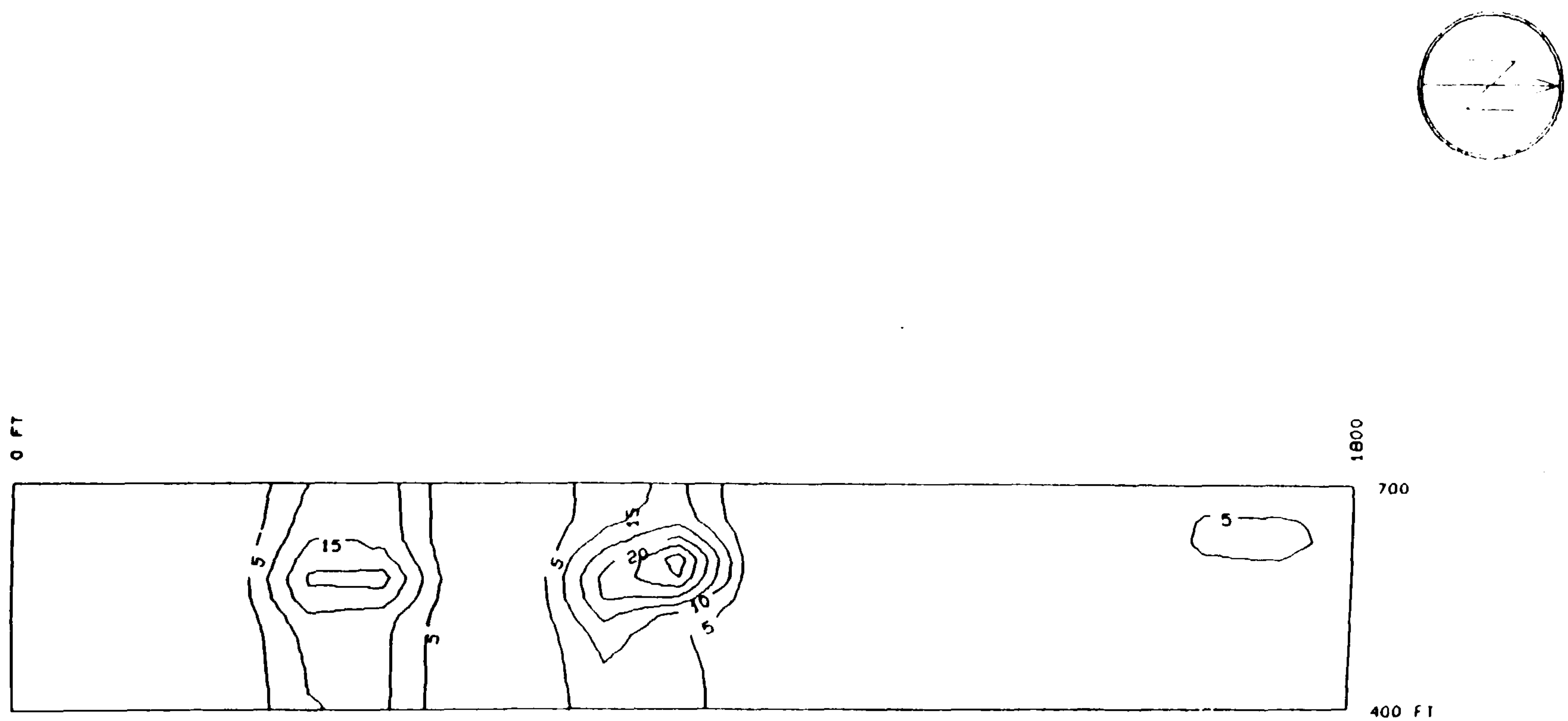
Figure 58



CS - A
Nickel Concentrations

THE AVENDT GROUP, INC

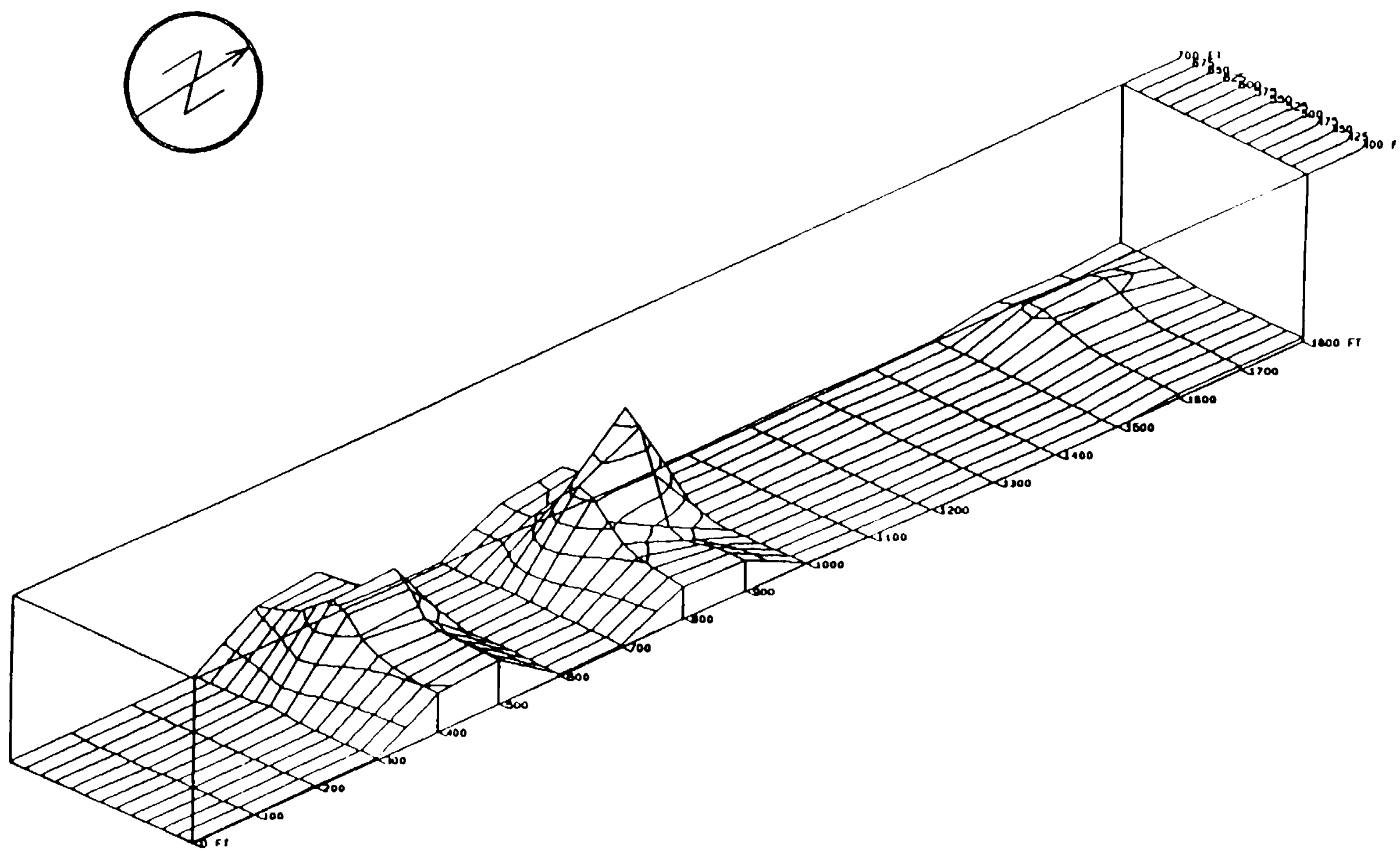
Figure 59



CS - A
Selenium Concentrations

THE AVENDT GROUP, INC.

Figure 60



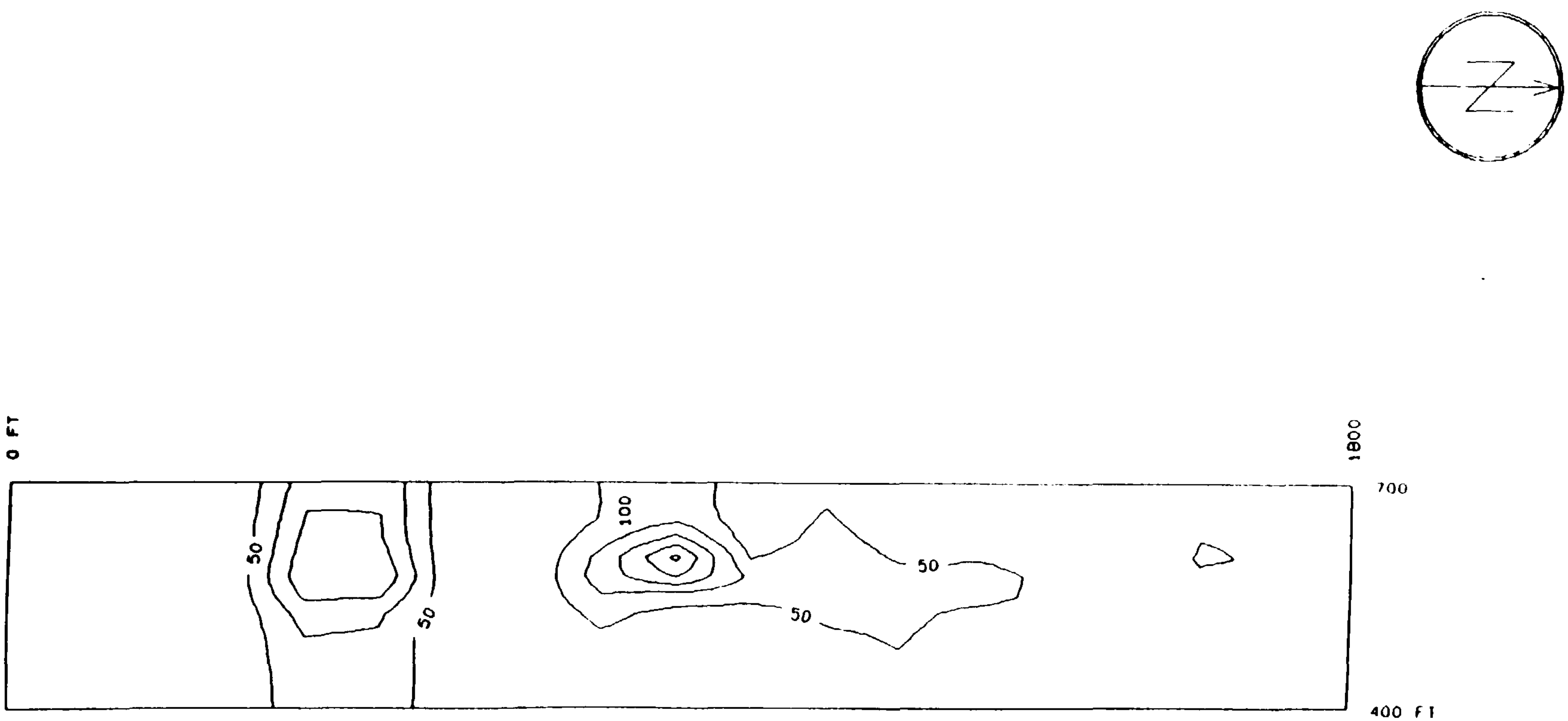
CS-A
Selenium Concentrations

X Y Z=1 1 10

THE AVENDT GROUP, INC

Figure 61

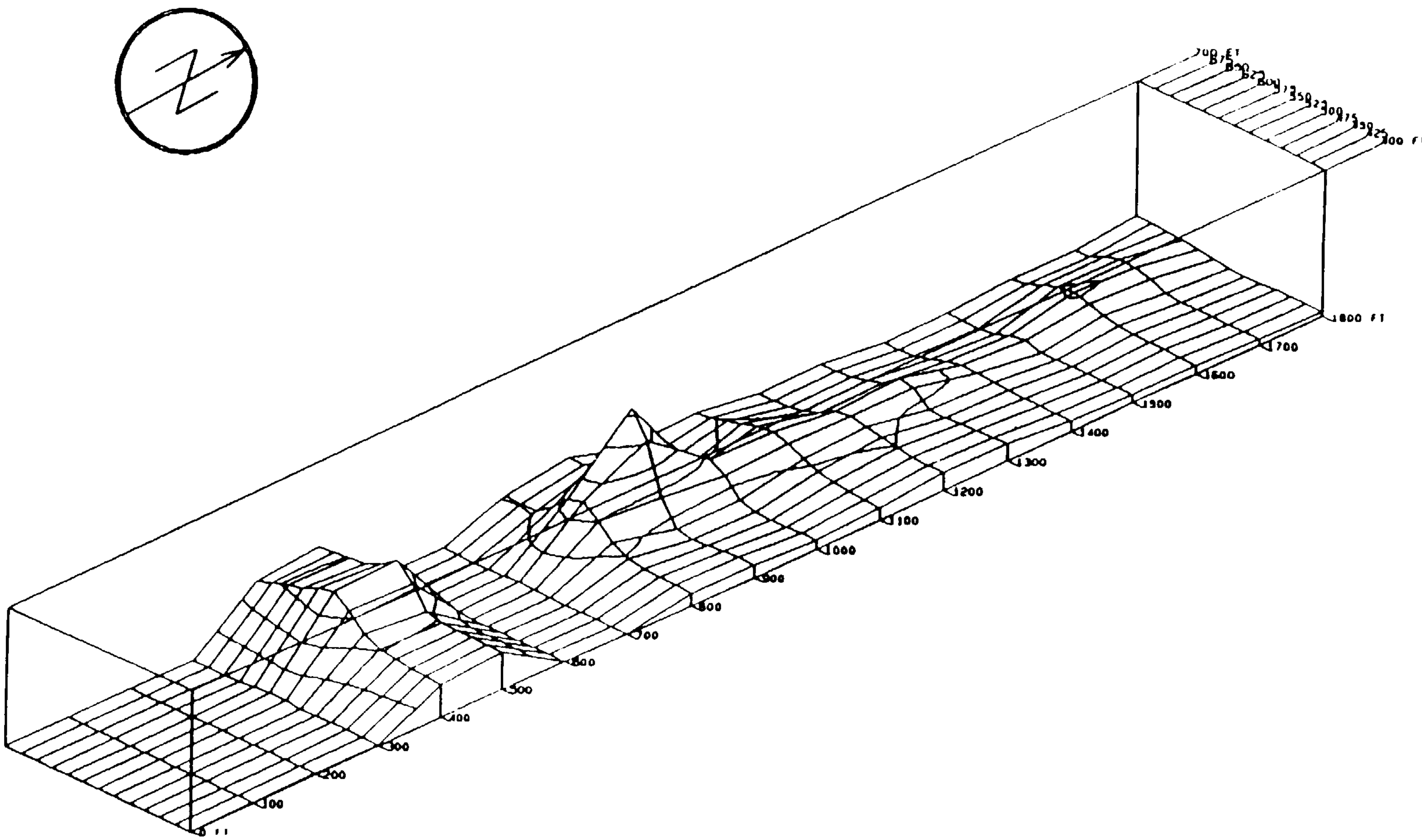
RENUM001837



CS - A
Silver Concentrations

THE AVENDT GROUP, INC.

Figure 62

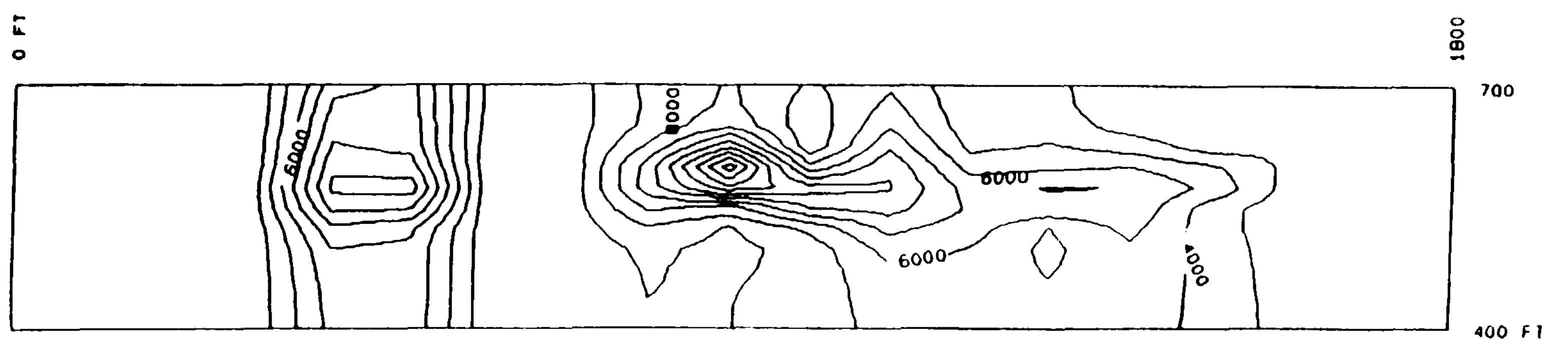


CS - A
Silver Concentrations

THE AVENDT GROUP, INC

Figure 63

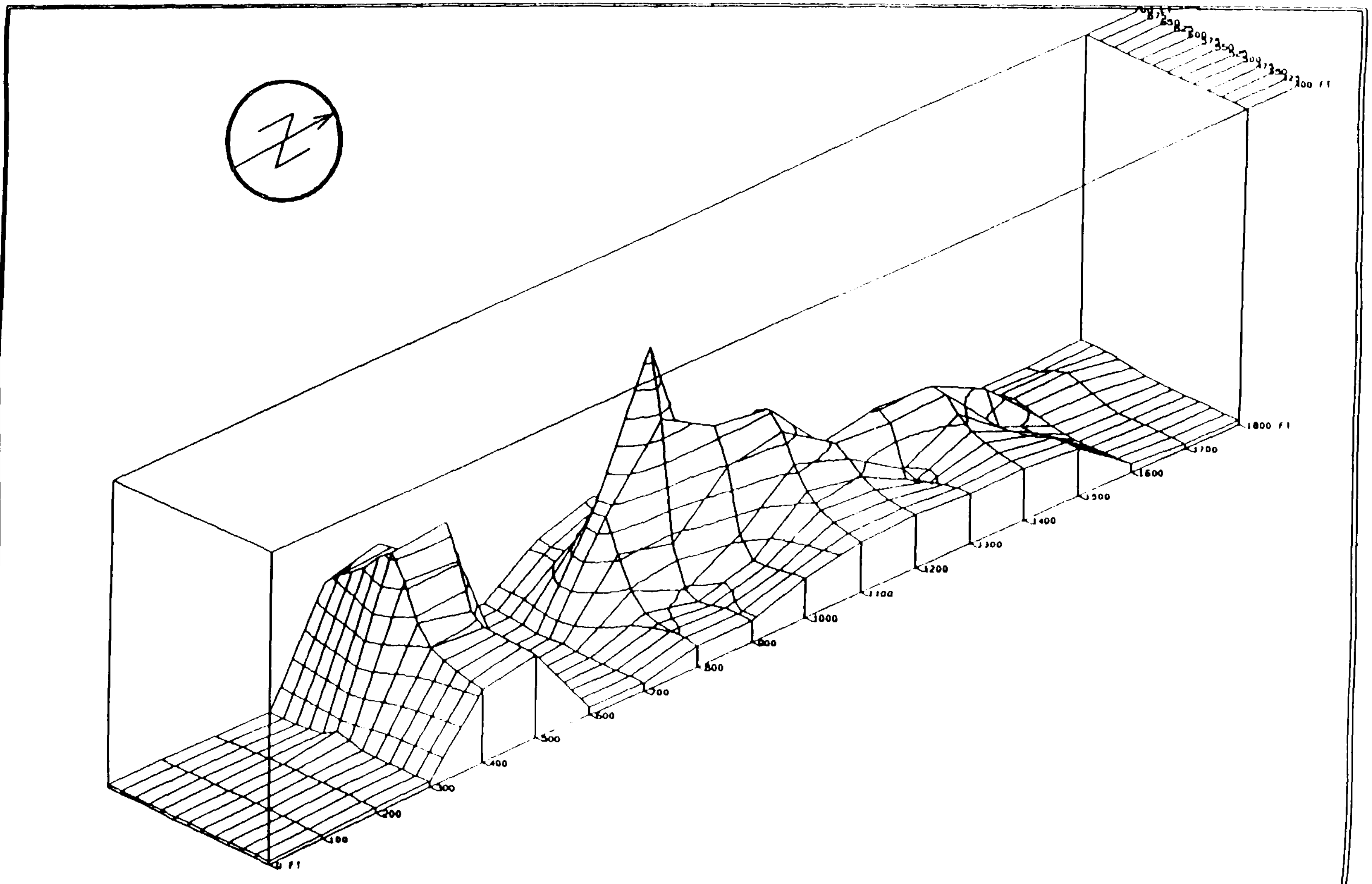
RENUM001839



CS - A
Zinc Concentrations

THE AVENDT GROUP, INC

Figure 64



CS - A
Zinc Concentrations

THE AVENDT GROUP, INC

Figure 65

4.5 Organic Analysis

4.5.1 Volatile Organic Compounds

The results of the Appendix IX compound search indicate that nine volatile organic compounds are present in the creek channel sediments (Table 8). The volatile organic compounds were tested using SW-846, Method 8240. The compounds methylene chloride, acetone, 1,2-dichloroethene (total), trichloroethene, toluene, chlorobenzene, ethylbezene, xylene (total), and dichlorodifluoromethane were detected. Review of these compounds indicates that the highest values of each of these compounds occur on the A16 transverse, the northernmost sampling point (Plate 2).

4.5.2 Semi-Volatile Compounds

The Appendix IX compound search indicated that 16 semi-volatile compounds are present in the creek bottom sediments of CS-A (Table 9). The semi-volatile organic compounds were tested using SW-846, Method 8270. The compounds phenol, 1,3-dichlorobenzene, 1,4-dichlorobenzene, benzyl alcohol, 1,2-dichlorobenzene, 4-methylphenol, 2,4-dimethylphenol, benzoic acid, 1,2,4-trichlorobenzene, 4-chloroaniline, 3-methylphenol, acetophenone, 1,2,4,5-tetrachlorobenzene, pentachlorobenzene, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate were detected (Table 9). Review of the semi-volatile data indicates that the highest concentrations also occur along transverse A16 (Table 9) (Plate 2).

4.6 Hazardous Waste Characteristics

4.6.1 Characteristic of Ignitability

Twenty-four of the sediment/soil samples collected from the CS-A project site were analyzed for the characteristics of ignitability using SW-846, Method 1010. Only sample A13C, at the 4-8.5 depth exhibited the characteristics of ignitability having a flash point of 98 degrees Fahrenheit (Table 10).

Table 8

CS - A

Volatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	13-
PARAMETERS														
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND	ND	580 J	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	1600 B	1500 B	1700 B	25000 B	5400 B	4400 B	2500 B	2300 B	3800 B	20000 B	30000 B	5800 B	3100 B	2100
Acetone	ND	1000 JB	690 JB	22600 JB	4500 JB	2400 JB	1300 JB	2300 B	6300 B	16000 B	23000 JB	4100 JB	2000 JB	2400
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	1600	ND	6400 J	ND	260 J	ND
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	15000	ND	ND	1400	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1600 J	ND	ND
1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Acetate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	740 J	ND	ND	ND	ND	ND	ND	ND	870 J	100000	14000 J	ND	690 J	2100
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	440 J	2600 J	8800 J	ND	ND	ND
Trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	380 J	680 J	ND	ND	4600 J	11000 J	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	330 J	ND	ND	ND	ND	ND
Toluene	ND	ND	170 J	ND	690 J	ND	ND	ND	ND	7200 J	ND	ND	ND	5700
Chlorobenzene	650	240 J	530 J	5200 J	4600	2100	590 J	420 J	1100 J	31000	24000	6100	620 J	18000
Ethylbenzene	1100	2300	ND	3600 J	ND	1400 J	ND	ND	1400 J	80000	50000	ND	560 J	330
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylene(total)	ND	350	3800	ND	ND	460 J	ND	ND	5200	500000	240000	ND	ND	ND
Acrolein	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acrylonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	170 J	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	ND	ND	ND	ND	ND	6900	ND	ND	ND	ND	ND	ND	ND	ND
Acetonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iodomethane	460 J	630 J	ND	ND	1700 J	1800 J	1300 J	1000 J	ND	ND	ND	3000 J	1000 J	ND
Propionitrile (Ethyl Cyanide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Chloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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Table 8
(Cont.)

Volatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23A
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	19-20
PARAMETERS														
Methacrylonitrile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isobutyl alcohol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-Tetrachlorethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-Trichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloro-1,3-Butadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 9

CS - A

Semivolatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	A23A
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	19-[illegible]
PARAMETERS														
Phenol	ND	720 JB	ND	ND	ND	1300 J	ND	ND	ND	610000 B	21000 JB	ND	ND	3800
bis(2-Chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	ND	ND	ND	3200 JB	ND	5100	ND	120 J	4900 J	32000 J	23000 J	ND	ND	ND
1,4-Dichlorobenzene	210 J	ND	3600 J	58000	18000 J	39000	730	1100	64000	390000 B	260000 B	13000 J	34000 J	2900
Benzyl Alcohol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8200
1,2-Dichlorobenzene	58 J	ND	840 J	6100 JB	ND	12000	210 J	1100	74000	650000 B	360000 B	ND	ND	6100
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1200
N-Nitoroso-Di-n-propylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
[illegible]trophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
[illegible]-Dimethylphenol	ND	1600 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5500
Benzoic Acid	ND	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND	ND	ND	28000
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	ND	ND	8800	12000 J	31000 J	47000	ND	490	46000	160000 B	12000 JB	6000 J	ND	9500
Naphthalene	130 J	ND	850 J	ND	ND	ND	ND	ND	ND	ND	5600 J	ND	ND	1500
4-Chloroaniline	140 J	17000	9400	13000 J	ND	ND	ND	ND	ND	ND	14000 J	ND	ND	7300
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	600 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methacrylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyridine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methacrylate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Picoline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosomethylethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl methanesulfonate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3600
Pentachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	120[illegible]
N-Nitrosopyrrolidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
[illegible]tophenone	150 J	ND	1300 JB	ND	ND	24000	320 J	140 J	8100 J	ND	4300 JB	ND	ND	2900
[illegible]itrosomorpholine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosopiperidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
a,a-Dimethyllphenethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 9
(Cont.)

Semivolatile Organic Analysis

SAMPLE I.D. : DEPTH (ft) :	A10 15-17	A11B 4-8	A11C 2-6.5	A12B 3-7	A12C 4-9	A13B 4.5-6	A14C 8.5-10	A15B 6-9	A15C 4.5-9	A16B 9-12	A16C 2-5	A21C 4-8	A22B 0-7	A23A 19-20
PARAMETERS														
Hexachloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Phenylenediamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-butylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Safrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	ND	ND	19000	3100 J	8000 J	28000	ND	140 J	10000 J	19000 J	ND	ND	ND	ND
Isoafrole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Naphthoquinane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorobenzene	ND	ND	13000	4400 J	18000 J	19000	260 J	380 J	28000	37000 J	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chlorophenyl-phenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	ND	ND	800 J	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine (1)	110 J	ND	ND	ND	ND	ND	ND	49 J	2500 J	ND	4200 J	ND	ND	ND
4-Bromophenyl-phenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	1700 J	ND	ND	ND	ND	59 J	4300 J	ND	ND	ND	ND	ND
Pentachlorophenol	800 J	ND	ND	ND	ND	ND	ND	88 J	ND	ND	ND	ND	ND	ND
Phenanthrene	66 J	ND	670 J	3000 J	ND	1800 J	ND	ND	1800 J	ND	5400 J	4900 J	14000 J	790
Anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-Butylphthalate	55 JB	1100 JB	1100 JB	ND	4400 J	ND	ND	56 J	ND	ND	ND	ND	ND	2900
Fluoranthene	ND	ND	540 J	3900 J	6700 J	1400 J	ND	ND	ND	ND	3600 J	8100 J	ND	ND
Pyrene	ND	ND	540 J	4900 J	ND	1500 J	ND	ND	ND	ND	4200 J	8300 J	10000 J	ND
Butylbenzylphthalate	ND	ND	ND	ND	ND	1100 J	ND	160 J	11000 J	70000 JB	100000 B	ND	ND	620
3,3´-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5700 J	4800 J	ND	1000
(2-Ethylhexyl)phthalate	75 J	ND	ND	3400 J	8600 J	6200 B	190 JB	240 JB	11000 JB	26000 JB	ND	6700 J	ND	2000
..-n-octyl phthalate	ND	ND	ND	ND	3800 J	ND	ND	ND	ND	ND	18000 JB	7300 J	ND	ND
Benzo(b)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	ND	ND	ND	ND	ND	ND	ND	ND			--	ND	ND	ND
Benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND	ND	ND					ND	ND

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Table 9
(Cont.)

Semivolatile Organic Analysis

SAMPLE I.D. :	A10	A11B	A11C	A12B	A12C	A13B	A14C	A15B	A15C	A16B	A16C	A21C	A22B	[illegible]
DEPTH (ft) :	15-17	4-8	2-6.5	3-7	4-9	4.5-6	8.5-10	6-9	4.5-9	9-12	2-5	4-8	0-7	[illegible]
PARAMETERS														
1,4-Dioxane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Naphthylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	10000 J	ND	ND	ND	ND
1,3,5-Trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diallate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenacetin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diphenyiamine	110 J	ND	ND	ND	ND	ND	ND	42 J	2500 J	ND	4200 J	ND	ND	ND
5-Notro-o-toluidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Aminobiphenyl	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pronamide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-sec-Butyl-4,6-dinityophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachloronitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitroquinoline-1-oxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methapyrilene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
mite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
lorobenzilate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Dimethylaminoazobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3,3'-Dimethylbenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Aacetylaminofluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
7,12-Dimethylbenzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorophene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylcholanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

** Units: Ug/Kg **

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Table 10

CS - A

Characteristics of Hazardous Waste

Sample I.D.		Date	Ash (%)	Solids (%)	Alkalinity (%)	Cyanide Reactive (mg/kg)	Cyanide Total (mg/kg)	Flash Point (deg F)	pH	Sulfide mg/kg	Sulfide Reactive (mg/kg)	Total PCBs	Observed Creek Sediment
A10	6-7	08/22		85.9								0	
A10	9-10	08/22		64.4								0	
A10	15-17	08/22	96.8	76.3	0.87	ND	ND	>200	7.9	ND	ND	.48	
A10	20-22	08/22		70.6								1.4	
A10	24-29	08/22		73.2								14.3	
A10	37-38	08/22		81.0								3.88	
A11A	8-13	07/19		71.9								0	
A11A	13-18	07/19		65.8								0	
A11B	4-8	07/18	96.8	72.6	0.12	ND	ND	>200	7.7	86.0	ND	.53	
A11B	8.1-10.6	07/18		57.3								.21	
A11B	12-17	07/18		76.9								.92	
A11C	2-6.5	07/18	99.7	72.6	ND	ND	ND	>200	7.6	ND	ND	55	
A11C	6.5-10.5	07/18		78.0								13	
A11C	12.5-16.5	07/18		83.7								1.3	
A11D	8-10	07/18	80.8	72.9	0.13	ND	2.5	>200	8.8	ND	ND	0	
A11D	18.5-23.5	07/18	98.5	82.2	0.13	ND	ND	>200	8.0	ND	ND	38	
A12A	8-11	07/19		74.2								0	
A12A	11-20.5	07/19		79.4								.067	
A12B	3-7	08/22	89.0	12.2	6.3	ND	1.6	>200	6.9	ND	ND	32	*
A12B	9-12	08/22		75.3								13.83	
A12B	14-17	08/22		80.6								0	
A12B	17-19	08/22		78.6								.27	
A12C	4-9	07/12	91.7	55.8	1.0	ND	ND	>200	6.2	ND	ND	0	*
A12C	10-13	07/12		78.5								0	
A12C	14-16	07/12		82.8								0	
A12D	6-13	07/18		76.2								530	
A12D	17-20	07/18	98.6	74.1	0.17	ND	ND	>200	7.9	ND	ND	101	
A12D	20-25	07/18		81.3								15.8	
A13A	9-14	07/20										0	
A13A	14-19	07/20										0	
A13A	19-20.5	07/20										0	
A13B	4.5-6	07/11	86.1	32.9	2.2	ND	5.8	>180	6.6	ND	ND	440	*
A13B	6-9.5	07/11		74.9								50	
A13B	9.5-12	07/11		81.6								2.25	
A13C	4-8.5	07/12	91.3	41.0	1.5	ND	ND	98	6.2	ND	ND	910	*
A13C	6-13	07/12		77.5								25.5	
A13C	13-16	07/12		83.1								0	
A13D	18-23	07/19	99.2	76.0	0.14	ND	ND	>200	7.7	ND	ND	1.3	
A14A	4-9	07/20										.099	
A14A	13.5-23.5	07/20										.062	
A14A	23.5-28.5	07/20										0	
A14B	4-8.5	07/11	94.3	59.9	1.1	ND	ND	>200	6.6	ND	ND	114	*
A14B	8.5-13	07/11		84.1								6.3	
A14C	4-8.5	07/11	87.2	23.1	2.7	ND	2.9	>180	6.0	ND	ND	540	*
A14C	8.5-10.5	07/11		59.1								2.22	
A14C	13.5-16.5	07/11		84.0								6.2	
A14D	10-14	07/12	95.8	79.9	0.68	ND	ND	>200	8.0	ND	ND	0	
A14D	15-19	07/12		77.1								0	
A14D	24-29	07/12		84.5								0	

RENUM001848

Table 10
(Cont.)

Characteristics of Hazardous Waste

Sample I.D.	Date	Ash (%)	Solids (%)	Alkalinity (%)	Cyanide Reactive (mg/kg)	Cyanide Total (mg/kg)	Flash Point (deg F)	pH	Sulfide (mg/kg)	Sulfide Reactive (mg/kg)	Total PCBs	Observed Creek Sediment
A15A 9-14	07/20										0	
A15A 14-19	07/20										0	
A15A 19-24	07/20										0	
A15B 6-9	07/07	95.1	59.0	1.1	ND	ND	>200	7.9	ND	ND	3.7	
A15B 13-16	07/07		83.8								9	
A15B 16-19	07/07		79.6								0	
A15C 4.5-9	07/10	85.4	26.0	0.97	ND	1.8	>200	7.4	ND	ND	980	*
A15C 9.5-14.5	07/10		79.9								1.66	
A15C 14.5-17.5	07/10		82.3								17.3	
A15D 4-9	07/12	96.6	83.0	0.64	ND	ND	>200	8.5	ND	ND	0	
A15D 12-14	07/12		85.9								0	
A15D 19-24	07/12		81.2								0	
A15D 24-29	07/12		75.0								0	
A16A 9-14	07/20										0	
A16A 14-19	07/20										2.96	
A16A 24-29	07/20										0	
A16B 9-12	07/18	75.3	23.5	0.56	ND	19.2	>200	6.8	ND	ND	1600	*
A16B 14-19	07/18		74.7								5.4	
A16C 2-5	07/18	64.6	20.2	0.14	ND	5.8	>200	6.8	ND	ND	0	*
A16C 7-12	07/18		69.2								13	
A16C 12-17	07/18		79.7								1.55	
A16D 13-18	07/20										0	
A16D 18-23	07/20										.09	
A16D 23-31	07/20										0	
A16E 13-18	07/20										.81	
A16E 18-23	07/20										1.99	
A16E 25.5-28	07/20										.95	
A21B 1-6	08/22	80.6	40.3	2.1	ND	6.0	>200	7.0	1.7	ND	27	*
A21B 6-10	08/22		54.4								.2	
A21B 10-13	08/22		79.4								0	
A21C 4-8	07/14	87.7	23.2	4.2	ND	5.0	>200	7.2	ND	ND	30	*
A21C 8-11	07/14		72.9								0	
A21C 13-14.5	07/14		85.8								0	
A21D 4-9	07/10		82.8								.09	
A21D 9-14	07/10		78.1								.15	
A21D 14-19	07/10		69.6								0	
A22A 9-14	07/11		71.4								0	
A22A 19-22	07/11		79.4								0	
A22A 24-28	07/11		77.4								0	
A22B 0-7	08/22	97.4	72.9	0.88	ND	ND	>200	7.8	ND	ND	120	*
A22B 7-13	08/22		77.2								0	
A22C 3-9	08/22	94.9	70.4	1.1	ND	ND	>200	7.9	41.7	6.6	19	*
A22C 10-15	08/22		79.8								0	
A22D 4-9	07/11		80.7								12	
A22D 9-14	07/11		74.1								0	
A22D 24-27	07/11		84.8								0	
A23A 12-13	07/14		87.6								3.99	
A23A 13-19	07/14		74.0								6.9	
A23A 19-20	07/14	94.7	66.1	1.3	ND	ND	>200	8.6	9.4	ND	150	
A23A 21-23	07/14		83.8								1.6	

4.6.2 Characteristic for Reactivity

Twenty-four samples were collected and analyzed for the hazardous characteristic of reactivity using SW-846, Method 7332 and Method 7342. Review of the analysis results indicate that none of the twenty-four samples collected exhibited the characteristic of reactivity (Table 10).

4.6.3 Characteristic for Corrosivity

Twenty-four samples were analyzed for the hazardous characteristic of corrosivity using SW-846, Method 9045. The pH of the twenty-four samples analyzed by this method ranged from 6.0 to 8.8 pH units. Based on these results, none of the samples exhibited the characteristics of corrosivity as outlined in 40 CFR 261.22 (Table 10).

RENUM001851

5.0 CONCLUSIONS - AVENDT WORK

5.1 Site Investigation

The site investigation performed by AGI at CS-A identified five (5) unconsolidated stratigraphic units; fill material, fluidized creek sediments, the Cahokia Unit, a discontinuous clay layer and the Henry Formation. Fill material, which is the uppermost unit encountered outside of the creek channel ranged in thickness from one to 15 feet. The fluidized creek bottom sediments ranged in thickness from one-half foot to 11 feet thick. This unit was the uppermost unit encountered within the creek channel. The Cahokia Unit, which is situated on top of the Henry Formation, ranges in thickness from one (1) to 20 feet thick. The Cahokia Unit consists of sediments of the upper Henry Formation which were reworked by the Mississippi River. The Henry Formation is the lowermost unit encountered at the study area. This unit is 98 to 103 feet thick and extends to the bedrock surface which is approximately 110 feet below the surface.

CS-A was characterized through a network of 34 soil borings. The results of the boring program indicate that there is approximately 19,500 cubic yards of contaminated creek bottom sediments within CS-A. This estimate was derived by subdividing the creek into eight discrete zones, measuring the width and length of each zone, determining the average depth of creek bottom sediments in each zone, and calculating the volume of sediment in each zone. The eight zone volumes were added together to determine the total volume of sediments within the creek channel. The creek sediment analysis statistics are presented in Table 11.

5.2 Chemical Characterization

5.2.1 Manufacturing Process Involved in PCB Synthesis

As part of the investigation performed by The Avendt Group, Inc., a literature search was performed to determine the industrial process used to produce PCBs. Direct chlorination of biphenyl in the presence of a catalyst is the method most commonly used by industry for the production of PCBs (Romo, 1988; Hutzinger, Safe, Zitko, 1983).

TABLE 11
CREEK SEGMENT - A
CREEK SEDIMENT ANALYSIS STATISTICS

PARAMETER	CONCENTRATION RANGE (PPM)	CONCENTRATION ARITHMETIC MEAN	CONCENTRATION GEOMETRIC MEAN
TOTAL PCBs (PPM)	ND - 1,600.00	85.78	27.5423
PCB PRECURSORS (PPM)			
BIPHENYL	0.10 - 24.00	6.60	1.1238
CHLOROBIPHENYL	0.02 - 160.00	33.58	1.2254
DICHLOROBIPHENYL	0.05 - 160.00	47.70	8.7297
TRICHLOROBIPHENYL	0.10 - 24.00	5.69	0.7716
TETRACHLOROBIPHENYL	0.03 - 21.00	5.35	1.0899
PENTACHLOROBIPHENYL	ND - 550.00	144.30	16.3418
HEXACHLOROBIPHENYL	ND - 640.00	270.62	27.8997
DECACHLOROBIPHENYL	ND - 640.00	279.12	68.6119
EPTOX METALS (PPM)			
CADMIUM	0.01 - 4.00	1.47	0.6309
LEAD	0.10 - 35.40	6.80	2.0309
ARSENIC	ND - 0.35	0.04	0.0155
BARIUM	ND - 3.90	1.49	1.3079
CHROMIUM	ND - 0.60	0.07	0.0300
TOTAL METALS (PPM)			
SILVER	2.40 - 348.00	118.42	69.1830
ALUMINUM	1400.00 - 8050.00	4020.77	3715.3523
ARSENIC	ND - 194.00	64.25	33.8844
BARIUM	241.00 - 5200.00	1347.31	933.2543
BERYLLIUM	ND - 44.10	12.28	5.2480
CALCIUM	ND - 17000.00	10433.85	9772.3722
CADMIUM	2.60 - 532.00	217.80	106.6350
COBALT	ND - 78.00	27.35	22.1870
CHROMIUM	62.00 - 695.00	345.67	255.7407
COPPER	1160.00 - 91800.00	32628.46	21081.4270
IRON	10100.00 - 312000.00	113300.00	76225.4500
MERCURY	ND - 124.00	30.52	9.2789
MAGNESIUM	ND - 7800.00	3140.77	2755.4974
MANGANESE	40.10 - 379.00	184.65	148.8332
SODIUM	ND - 7800.00	2626.62	2116.4109
NICKEL	95.20 - 2230.00	1478.78	973.1952
LEAD	145.00 - 32400.00	10069.54	4555.1219
ANTIMONY	ND - 356.00	116.23	72.9625
SELENIUM	ND - 41.60	13.10	6.3899
VANADIUM	ND - 43.00	30.[illegible]	25.2638
ZINC	373.00 - 26800.00	10[illegible]	6254.6066

TABLE 11 (CON'T)
CREEK SEGMENT - A
CREEK SEDIMENT ANALYSIS STATISTICS

PARAMETER	CONCENTRATION RANGE (PPM)	CONCENTRATION ARITHMETIC MEAN	CONCENTRATION GEOMETRIC MEAN
VOLATILES (PPM)			
1,1-DICHLOROETHANE	ND - 13.00	4.38	2.6157
1,2-DICHLOROETHENE	ND - 15.00	6.51	3.9039
TRICHLOROETHENE	ND - 100.00	16.83	4.1610
CHLOROBENZENE	ND - 31.00	8.77	3.7393
ETHYLBENZENE	ND - 80.00	17.62	4.0188
XYLENE(TOTAL)	ND - 500.00	95.55	8.3425
DICHLORO-DIFLUORMETHANE	ND - 31.00	11.68	7.7428
SEMI-VOLATILES (PPM)			
1,3-DICHLOROBENZENE	ND - 73.00	25.90	16.1733
1,4-DICHLOROBENZENE	ND - 99.00	43.88	36.2243
1,2-DICHLOROBENZENE	ND - 99.00	44.51	32.0331
1,2,4-TRICHLOROBENZENE	ND - 99.00	40.75	28.3595
ACETOPHENONE	ND - 99.00 24	36.68	24.3837
1,2,4,5-TETRACHLORO-BENZENE	ND - 73.00	25.01	17.3620
PENTACHLOROBENZENE	ND - 73.00 28	29.80	23.6428
[illegible]	ND - 17		

NOTES:

- For calculations of mean values, detection limits were substituted for reported 'ND' and 'BDL' data points.
- Geometric Mean calculated according to the method described in *Water & Sewage Works*, June/July: 1976, article titled 'Estimating the Reliability of Advanced Waste Treatment' by Robert B. Dean, Science Advisor, EPA.

RENUM001854

5.2.2 Indications of Biphenyl Present with PCBs

Several PCBs were detected in the sediments ranging from non-detect to 1600 mg/kg (Table 12). Chemical analysis shows that the PCB concentrations were highest at the north end of the creek, and decreased further south along the creek (Figure 66). The reported data for the PCB precursor, biphenyl, followed a similar pattern as the PCB concentrations (Figure 67) (Table 13).

5.2.3 Organic Analysis

The results of the Appendix IX compound search indicate that nine volatile organic compounds - methylene chloride, acetone, 1,2-dichloroethene (total), trichloroethene, toluene, chlorobenzene, ethylbenzene, xylene (total), and dichlorodifluoromethane were detected in the creek channel sediments (Table 8). The volatile organic compounds were tested using SW-846, Method 8240. The highest values of each of these compounds occur on the A16 transverse, the northernmost sampling point (Plate 2).

The Appendix IX compound search indicated that 16 semi-volatile compounds - phenol, 1,3-dichlorobenzene, 1,4-dichlorobenzene, benzyl alcohol, 1,2-dichlorobenzene, 4-methylphenol, 2,4-dimethylphenol, benzoic acid, 1,2,4-trichlorobenzene, 4-chloroaniline, 3-methylphenol, acetophenone, 1,2,4,5-tetrachlorobenzene, pentachlorobenzene, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate were detected in the creek bottom sediments of CS-A (Table 9). The semi-volatile data indicates that the highest concentrations also occur along transverse A16 (Table 9) (Plate 2).

5.2.4 EP Tox Metals

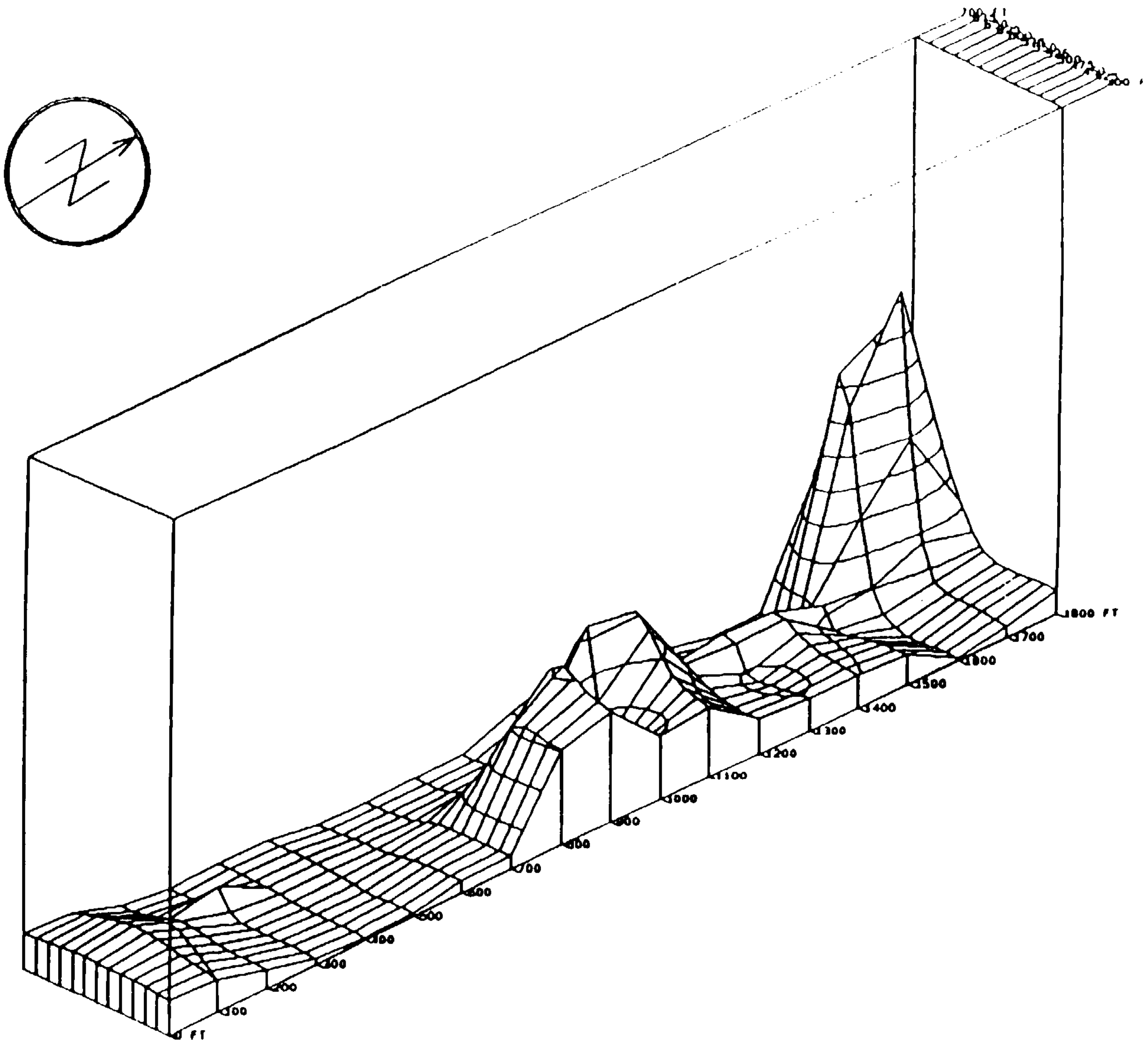
Review of the EP Tox analysis indicates that six EP Tox RCRA metals were within allowable EP Tox limits (Table 6). The creek-bottom sediments contain Cd and Pb above EP Tox limits at some locations (Table 6). The EP Tox limit for Pb and Cd was exceeded in isolated locations in the southern one-third to one-half of CS-A (Plate 2; Figures 35 and 37).

Table 12

CS - A

PCB Concentrations

SAMPLE IDENTIFICATION	PCB	CONCENTRATION(PPM)
A10B 24 - 29	AROCLOR 1221	10
A11B 4 - 8	AROCLOR 1254	.53
A11C 2 - 6.5	AROCLOR 1232	45
A12B 3 - 7	AROCLOR 1232	32
A12C (ALL)	AROCLOR (ALL)	ND
A13B 4.5 - 6	AROCLOR 1232	340
A13C 4 - 8.5	AROCLOR 1221	780
A14B 4 - 8.5	AROCLOR 1221	100
A14C 4 - 8.5	AROCLOR 1254	350
A14D (ALL)	AROCLOR (ALL)	ND
A15B 13 - 16	AROCLOR 1232	7.2
A15C 4.5 - 9	AROCLOR 1232	300
A15D (ALL)	AROCLOR (ALL)	ND
A16B 9 - 12	AROCLOR 1232	1600
A16C 2 - 5	AROCLOR (ALL)	ND
A21C 4 - 8	AROCLOR 1260	30
A21D (ALL)	AROCLOR (ALL)	ND
A22A (ALL)	AROCLOR (ALL)	ND
A22B 0 - 7	AROCLOR 1248	120
A22D 4 - 9	AROCLOR 1260	12
A23B 19 - 20	AROCLOR 1248	150

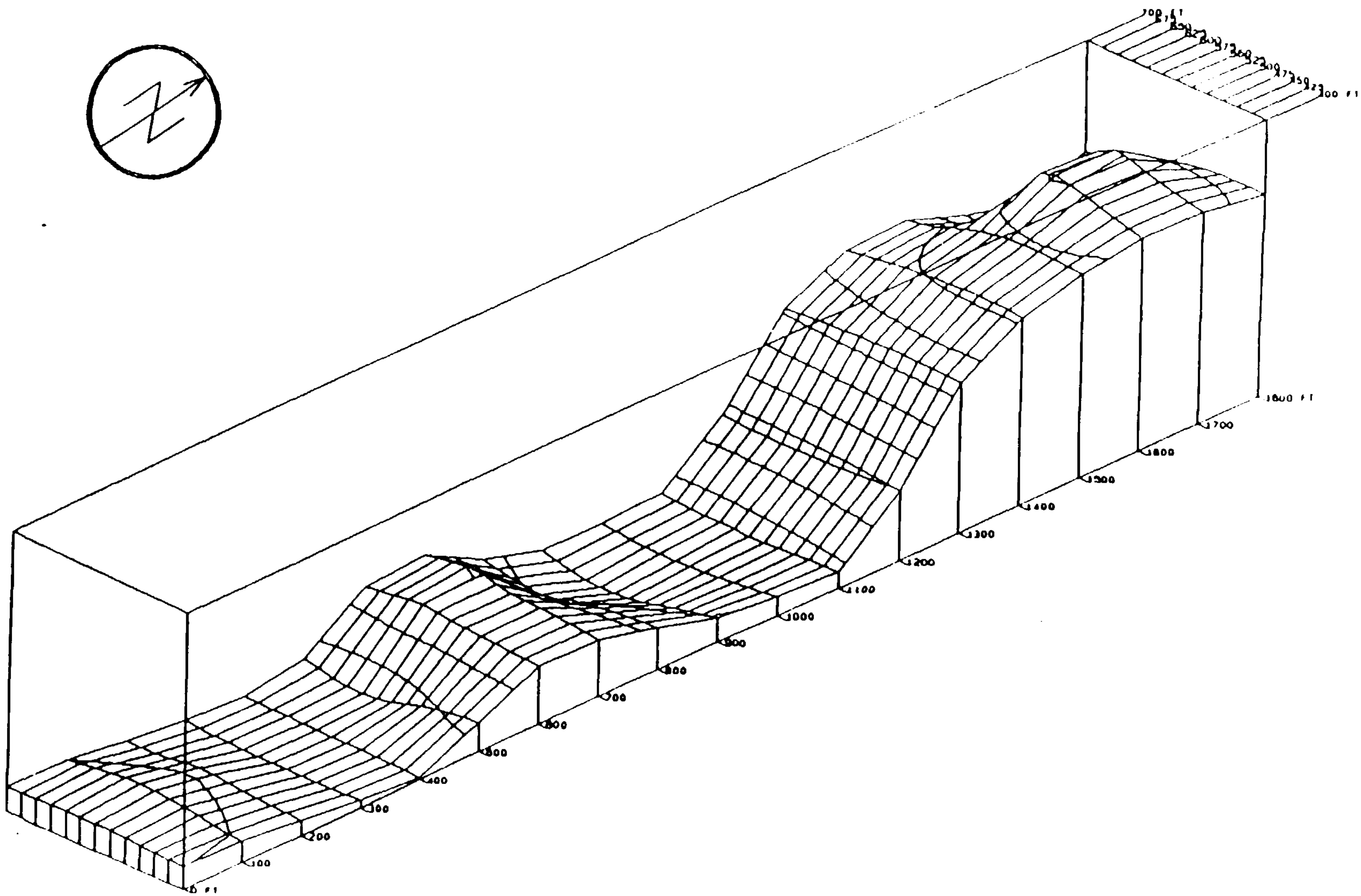


CS - A
PCB's Greatest Concentrations

X Y Z=1.1.1

THE AVENDT GROUP, INC.

Figure 66



CS - A
Biphenyl Concentrations

x y z=1 1 30

THE AVENDT GROUP, INC

Figure 67

TABLE 13

BIPHENYL CONCENTRATIONS

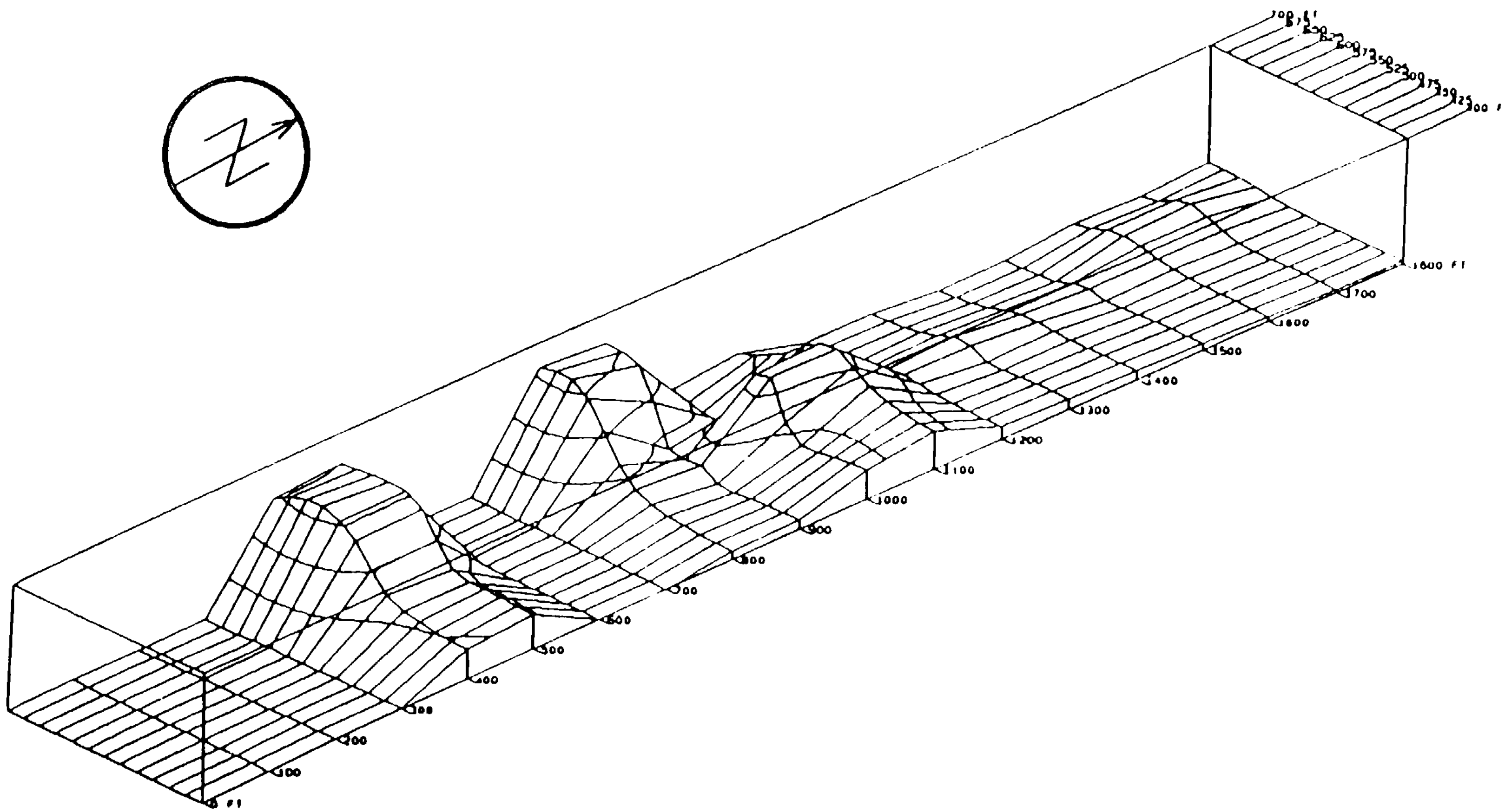
TABLE 13
CS - A
Biphenyl Concentrations

SAMPLE IDENTIFICATION	CONCENTRATION(mg/kg)	
A11B 4 - 8	6.6	J
A11C 2 - 6.5	5.2	J
A12B 9 - 12	0.08	J
A16B 9 - 12	8.3	J
A16C 2 - 5	24.0	J
A21B 1 - 6	0.1	J
A22B 0 - 7	0.3	J
A22C 3 - 9	0.3	J
A23C 21 - 23	2.9	J

» 'J' Indicates an estimated value for or an analyte that meets the identification criteria but the result is less than the specified detection limit.

5.3 Spatial Distribution

The laboratory reports from the Avendt investigation reveal the spatial distribution within CS-A. The laboratory reported values show the PCBs and biphenyl concentrations are highest at the north end of CS-A (Figures 66 & 67). The laboratory reported values show heavy metal concentrations are highest in the southern one-third to one-half of CS-A (Figures 68-73). The laboratory reported values for volatiles and semi-volatiles show the concentrations for these parameters to be highest at the northernmost sampling points within CS-A (Tables 8 and 9).



CS-A
EPTOX: Cadmium

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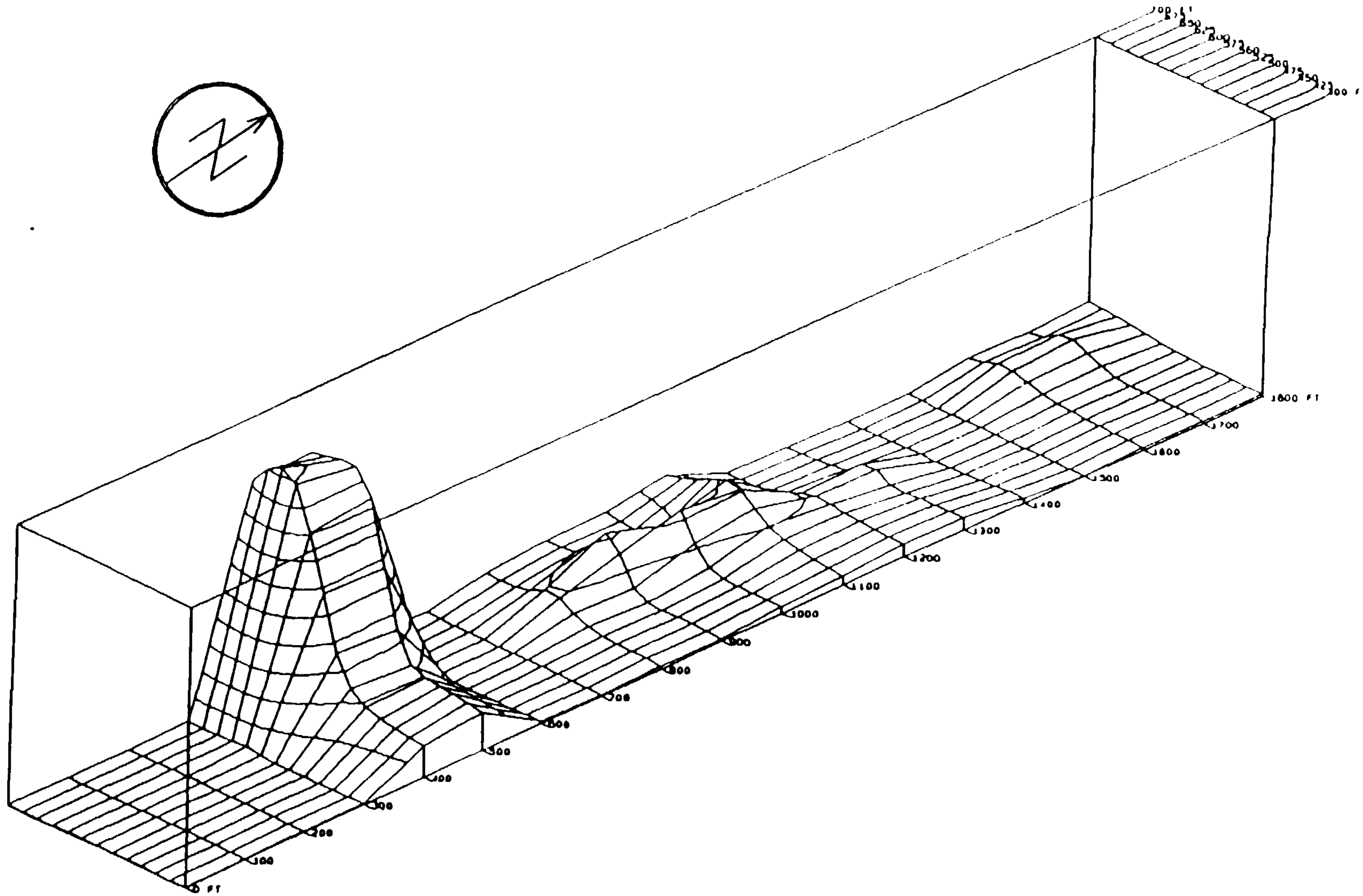
Figure 68



CS - A
EPTOX: Lead

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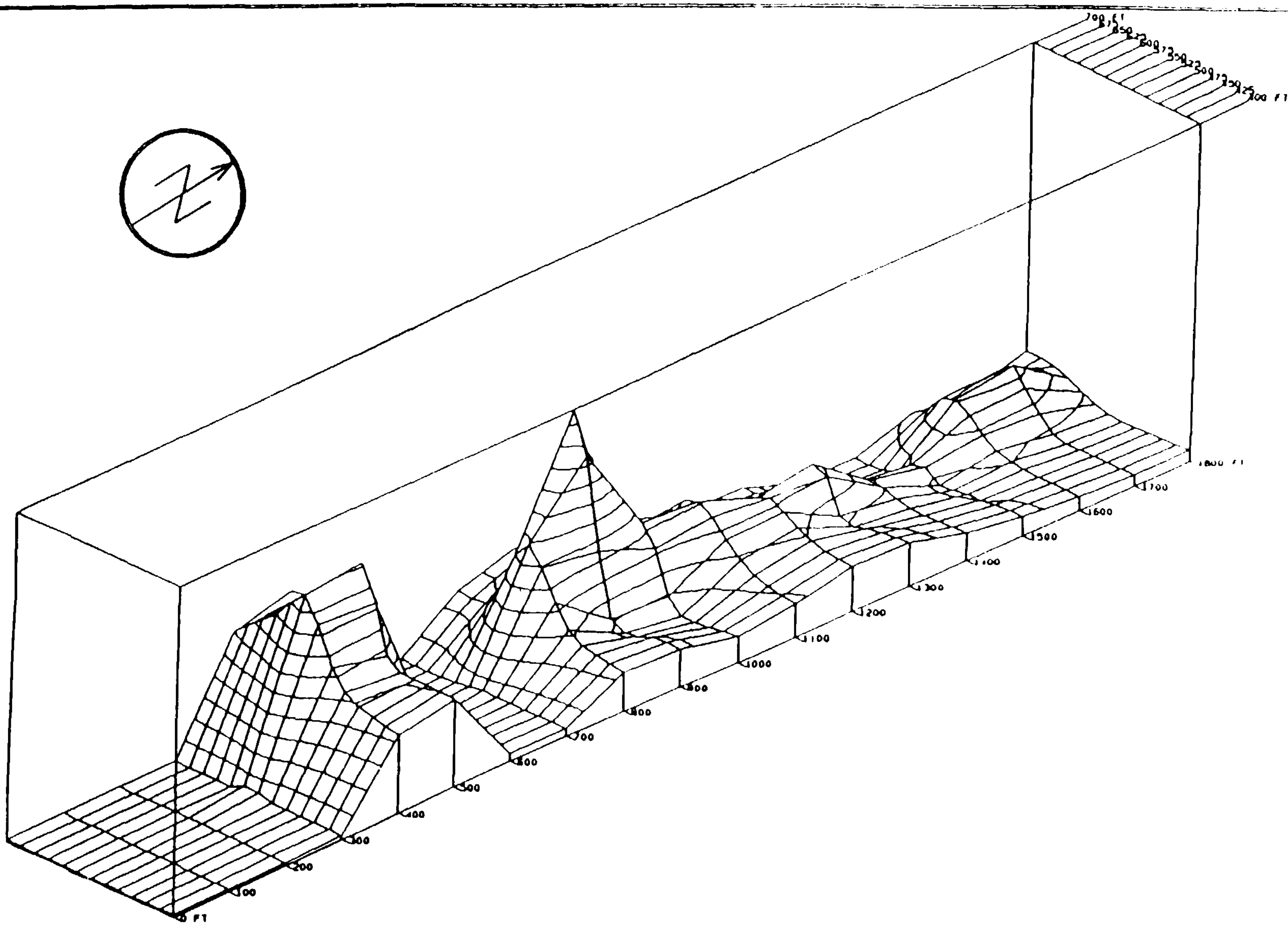
Figure 71

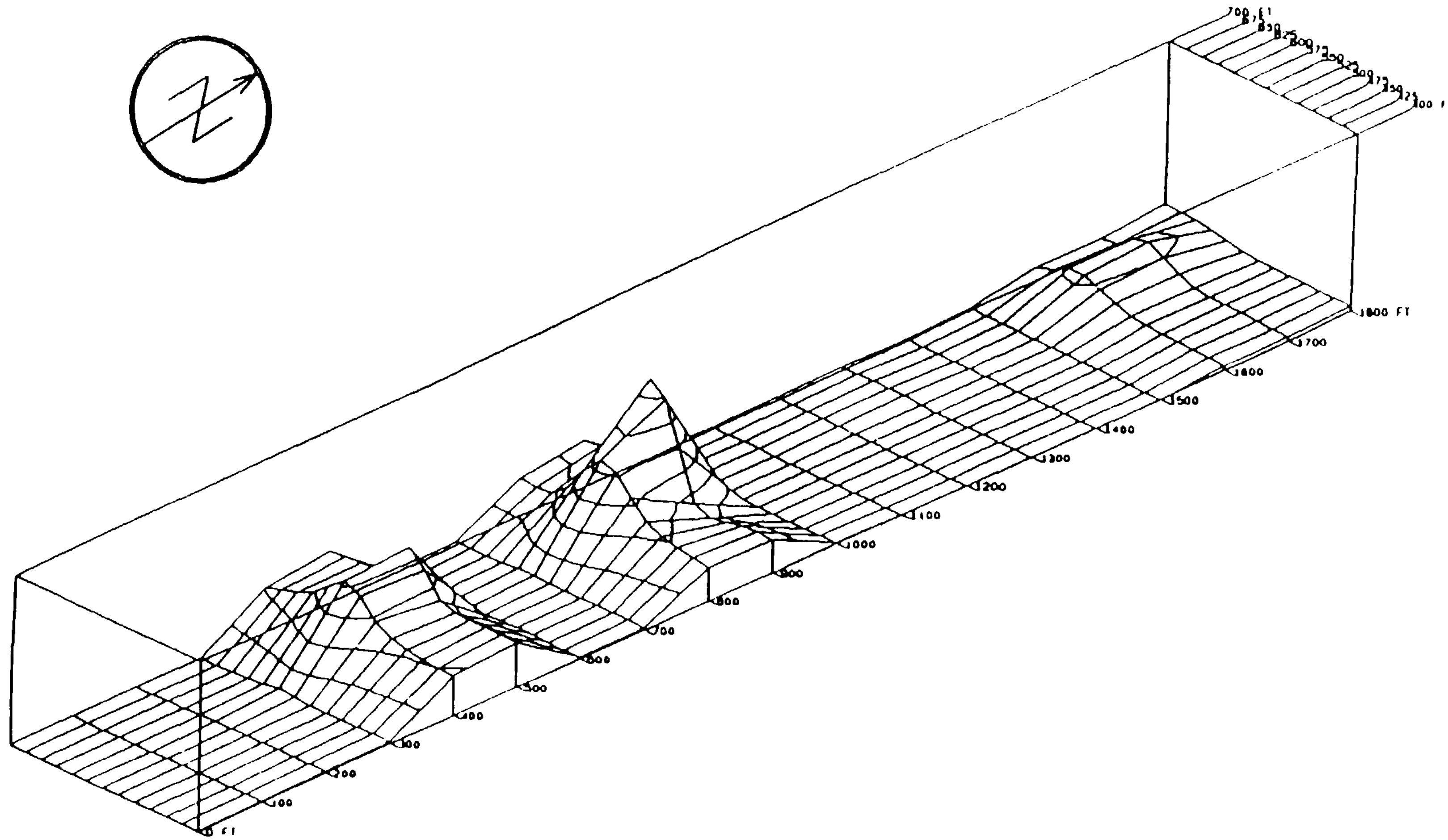


CS - A
Copper Concentrations

THE AVENDT GROUP, INC.

Figure 70

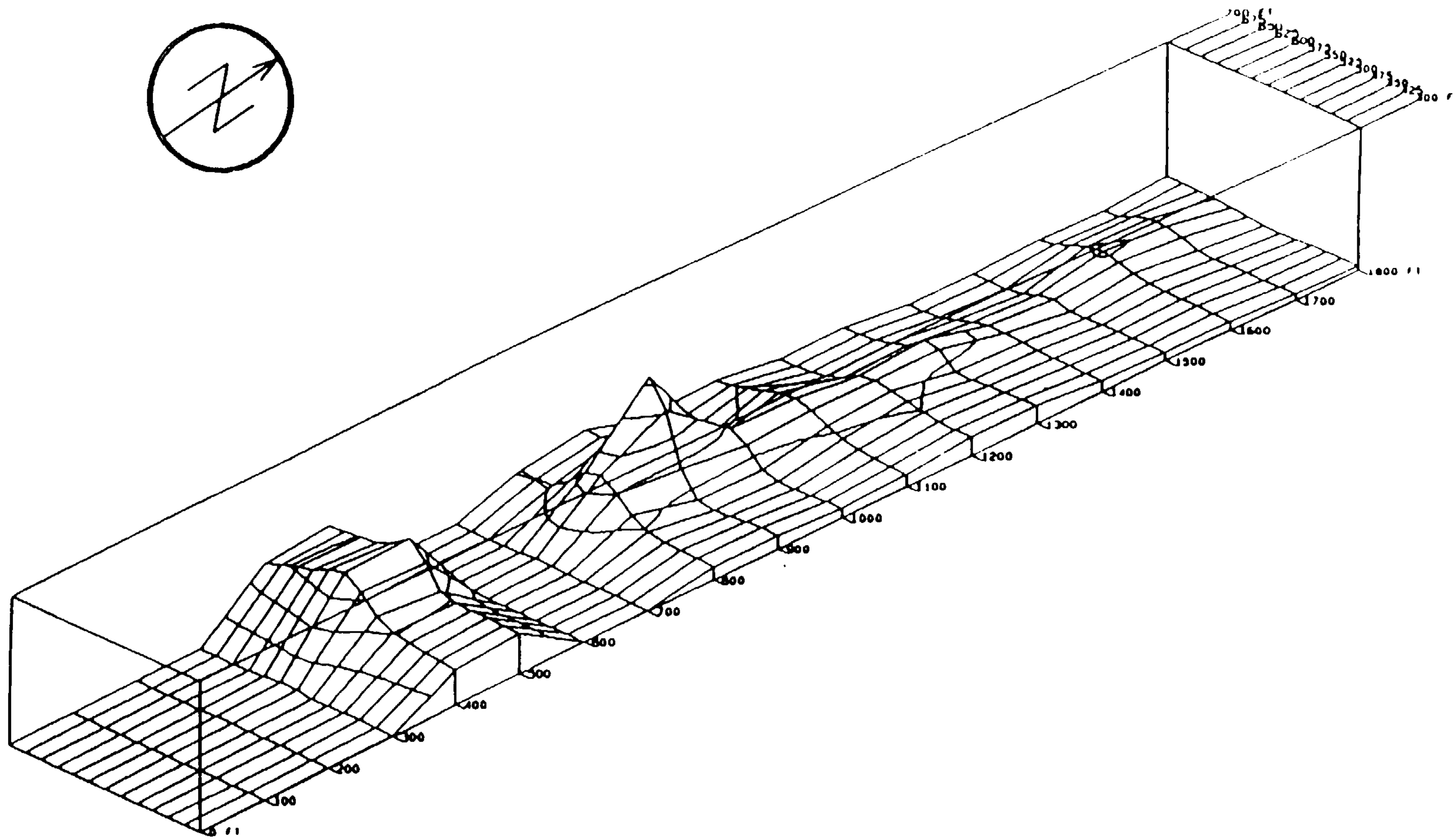
RENUM001865



CS - A
Selenium Concentrations

THE AVENDT GROUP, INC

Figure 71



CS - A
Silver Concentrations

Figure 72

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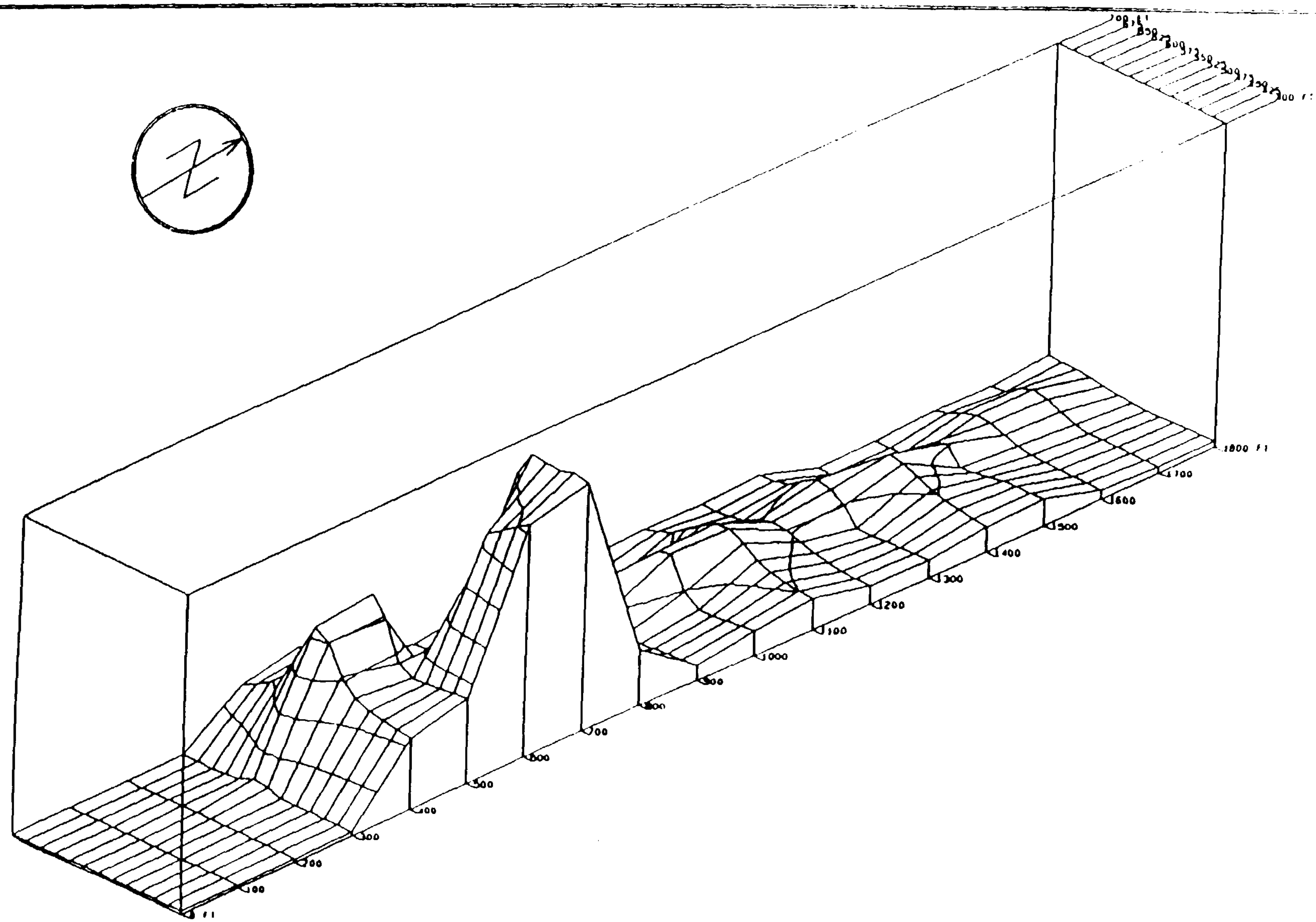

CS - A
Nickel Concentrations

THE AVENDT GROUP, INC

Figure 73

6

Cardinal

C6.1

RENUM001868

SITE INVESTIGATION/ FEASIBILITY STUDY

FOR

CREEK SEGMENT A

JUNE 1990

VOLUME II

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VOLUME II

LIST OF TABLES

6.0 REMEDIAL ACTION ALTERNATIVES EVALUATION FOR CS-A SEDIMENTS

6.1 Remedial Action Objectives

The purpose of the feasibility analysis is to evaluate and recommend remedial alternatives which will serve to 1) eliminate the potential recharge capacity of CS-A to regional groundwaters and 2) protect public health by controlling potential pathways of exposure and to recommend one alternative that achieves those objectives in a timely and cost effective manner. The feasible remedial alternatives, therefore, addressed the management of the readily identifiable contaminated sediments within CS-A in conformance with the National Contingency Plan (NCP).

6.2 Identification and Initial Screening of Technologies

The Avendt Group, Inc., initially screened 29 remedial technologies (Table 14) which are presented in EPA Document #EPA/625/6-85/006, the handbook on Remedial Action at Waste Disposal Sites, June, 1985.

TABLE 14

INITIAL REMEDIAL TECHNOLOGIES EVALUATION/SCREENING FOR CS-A CONTAMINATED SEDIMENTS

Remedial Technologies	Implementability*	Effectiveness**	Cost***
Multi-Layer Capping			
On-Site Incineration			
Off-Site Incineration			
Excavation and Removal			
On-Site Disposal	XXXXX		
Off-Site Disposal			
Lagoon Covers		XXXXX	
Grading			
Re-vegetation			
Dikes and Berms		XXXXX	
Channels and Waterways	XXXXX	XXXXX	
Seepage Basins and Ditches	XXXXX	XXXXX	
Sedimentation Basins and Ponds		XXXXX	
Levees and Floodwalls		XXXXX	
Active Interior Gas Collection Recovery/System	XXXXX	XXXXX	
Water Spraying	XXXXX	XXXXX	
Groundwater Pumping		XXXXX	
Slurry Walls			
Grouting	XXXXX	XXXXX	XXXXX
Sheet Piling	XXXXX	XXXXX	
Bottom Sealing	XXXXX	XXXXX	XXXXX
Bioreclamation	XXXXX	XXXXX	
Soil Flushing	XXXXX	XXXXX	
Immobilization	XXXXX	XXXXX	
Detoxification	XXXXX	XXXXX	
In-Situ Vitrification	XXXXX	XXXXX	XXXXX
Surface Microencapsulation	XXXXX	XXXXX	
Thermoplastic Solidification		XXXXX	
Liquid Injection	XXXXX	XXXXX	XXXXX
Fluidized Bed	XXXXX	XXXXX	

XXXXX - Basis for Elimination

* This criterion focuses on the technical feasibility and availability of the technologies each alternative would employ and the administrative feasibility of implementing the alternative.

** This criterion focuses on the degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risks and affords long-term protection, complies with ARARs, minimizes short-term impacts, and how quickly it achieves protection.

*** The costs of contruction and any long-term costs to operate and maintain the alternatives shall be considered.

6.3 Detailed Evaluation of Screened Remedial Action Alternatives

After the technology screening was completed, a number of these processes were included in four action alternatives, which were examined in detail in addition to the No Action Alternative.

The following are brief descriptions of the five alternatives.

1) NO ACTION

This alternative provides a base line against which the other actions can be measured. Under this alternative, the CS-A would be left in its existing state, which includes site security provisions.

2) OFF-SITE LANDFILL

This alternative involves the excavation of approximately 19,500 cubic yards of contaminated sediment. The excavated sediment will be dewatered by gravity separation to 75 percent solids, which will result in 10,400 cubic yards of solids to be disposed in a permitted landfill. During the removal of the contaminated sediments, entrained water will drain into the excavation or flow into the existing industrial sewer. Following the removal of the contaminated sediments, CS-A will be backfilled with clean fill, graded and vegetated.

3) OFF-SITE INCINERATION

Instead of being directly disposed in a permitted landfill, 10,400 cubic yards of solids will first be shipped to a permitted commercial incineration facility to destroy the 12% organic fraction. The incinerator residue, estimated at 6,900 cubic yards, will require chemical stabilization to retard potential leaching which will increase the volume of solids to be landfilled by an estimated fifty percent or to 10,400 cubic yards.

4) ON-SITE INCINERATION

Instead of being directly disposed in a permitted landfill, 10,400 cubic yards of solids will first be treated on site with a mobile incinerator. The on-site incinerator scrubber water will require treatment, and treatment sludge management, which will further increase the amount of solids requiring subsequent disposal. The residual material (ash and air pollution control residuals) would be further complexed to retard potential leaching of metals and disposed in an approved U. S. EPA landfill. CS-A would be filled to its original bank level elevation and graded with clean fill which would be re-vegetated.

5) MULTI-LAYER CAP

This alternative will involve the construction of a Resource Conservation and Recovery Act (RCRA) equivalent cap at grade over the contaminated sediments to provide containment and to minimize the migration of these contaminants. The construction of underground slurry walls will isolate the sediments from the groundwater and the regional groundwater contamination. Long-term operation, maintenance and monitoring of the facility will be required to ensure the integrity of the engineered containment for this alternative and restrictions would have to be placed on the property deed to prevent damage to the structure.

According to the Handbook, Remedial Action at Waste Disposal Sites (Revised: EPA/625/6-85/06), "The low permeability layer of the multi-layered cap can be composed of natural soils, admixed soils, a synthetic liner, or any combination of these materials. However, a synthetic liner overlying at least two feet of low permeability natural soil or soil admix is recommended because the synthetic liner allows virtually no liquid penetration for a minimum of 20 years, while the soil layer provides assurance of continued protection even if the synthetic liner fails."

Each of the alternatives was evaluated, according to current U. S. EPA guidance and Section 121 of SARA, which states that, "the selected remedy is to be protective of human health and the environment, cost effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable." Specifically, all alternatives were evaluated based on the following criteria contained in "Additional Interim Guidance on Superfund Selection of Remedy," dated July 24, 1987:

1. Overall protection of human health and the environment, which addresses whether or not a remedy provides adequate protection and considers how risks were eliminated, reduced, or controlled through treatment, engineering controls, or institutional safeguards.

2. Compliance with ARARs, which address whether or not the remedy will meet all of the applicable or relevant and appropriate requirements of environmental statutes.

3. Long-term effectiveness and permanence, which considers the ability of a remedy to maintain reliable protection of human health and the environment over time once remedial goals have been met.

4. Reduction of toxicity, mobility and volume, which considers the anticipated performance of the treatment technologies involved with a specific remedy.

5. Short-term effectiveness, which involves the period of time needed to achieve protection and any adverse impact on human health and the environment that may be posed during the construction and implementation period until remedial goals are achieved.

6. Implementability, which considers the technical and administrative feasibility of the remedy, including the availability of goods and services needed to implement the chosen solution.

7. Cost, which includes capital, operation, and maintenance and contingency costs.

8. Regulatory agency acceptance, which involves the impact of regulatory review and permitting necessary to achieve concurrence and implement the preferred alternative.

9. Community acceptance, which evaluates the public support of a given remedy.

A summary of these evaluations is shown in Table 15.

TABLE 15

COMPARATIVE ANALYSIS
REMEDIAL ACTION ALTERNATIVES
ACCORDING TO EVALUATION CRITERIA

Evaluation Criteria	ALT 1 No Action	ALT 2 Off-Site Landfill	ALT 3 Off-Site Incineration	ALT 4 On-Site Incineration	ALT 5 Multi- Layer Cap
Protection of Human Health and the Environment	Low	High	High	Medium	Low
Compliance With ARARs	Low	High	Medium	Medium	No
Long-Term Effectiveness and Permanence	Low	High	Medium	Medium	Low
Reduction of Toxicity Mobility and Volume	Low	High	High	High	Low
Short-Term Effectiveness	Low	High	High	Low	High
Implementability	High	High	Medium	Low	Medium
Cost* Capital O&M	--	12.0/	17.0/	20.0/	5.1/ 1.6 Million
Regulatory Acceptability	Low	High	High	High	Medium
Community Acceptance	Low	High	High	Low	Low

*Cost Figures Indicate: **Total Capital Cost (in Millions of Dollars)/**
Operation and Maintenance Costs are in Millions of Dollars and represent present worth of a 30-year proposed groundwater monitoring program.

6.3.1 Protection of Human Health and Environment

The protection of human health and the environment analysis involve the identification of potential exposure routes and an evaluation of the mitigation of contamination along those routes. The possible routes of exposure associated with the remediation of CS-A are: 1) air, 2) surface water, 3) groundwater, and 4) creek sediment.

6.3.1.1 NO ACTION

Under the No Action Alternative, the site would be left in its existing state which includes site security provisions. As a result, there would be no reduction in potential contaminant migration from the site, and the potential contact hazards associated with the contamination would not be minimized or eliminated once inside the fence which surrounds the site. Therefore, the No Action alternative will afford a low level of protection of human health and the environment.

6.3.1.2 OFF-SITE LANDFILL

The Off-Site Landfill Alternative will afford a high level of human health and environmental protection in the vicinity of the site. The excavation of sediments and disposal at an off-site landfill will eliminate sediment contamination as a source and the need for long-term monitoring, with but a minor and acceptable risk to human health and the environment along the travel routes to the landfill and at the landfill itself.

This alternative requires attention to the issues of worker safety and short-term impacts. The presence of hazardous or toxic materials can pose a risk to worker safety. Short-term impacts such as fugitive dust emissions, air releases, and contaminated run-off require mitigation.

6.3.1.3 OFF-SITE INCINERATION

The Off-Site Incineration Alternative would afford a high level of protection of human health and the environment at CS-A. The excavation of sediments, transportation for treatment at an off-site incinerator and subsequent landfill of residue will eliminate the sediments as a source and the need for long-term monitoring.

There will be a minor, but acceptable, risk to human health and the environment along the travel routes to the incinerator and then to the landfill, and with the landfill itself.

6.3.1.4 ON-SITE INCINERATION

The On-Site Incineration Alternative will afford a medium level of environmental protection in the vicinity of the site as a result of utilizing a single rotary kiln mobile incinerator in this remediation alternative. Off-site hauling would be required for transport of the incinerator residue.

6.3.1.5 MULTI-LAYER CAPPING

The Multi-Layer Capping Alternative will afford a low level of protection for human health and the environment. The degree of environmental and human health protection is contingent upon long-term maintenance of the integrity of the capping system. Land use restriction may be permanently imposed to protect the public health.

6.3.2 Compliance With Applicable or Relevant and Appropriate Requirements (ARARs)

The analysis for compliance of ARARs involves the identification of ARARs and an assessment of how each alternative will meet them. The types of ARARs are: 1) Chemical Specific, 2) Action Specific, 3) Location Specific, and 4) To be Considered.

6.3.2.1 NO ACTION

The No Action Alternative was determined not to comply with all Chemical, Action Specific and Location Specific ARARs as outlined in Table 16. It was determined that no To Be Considered ARARs are relevant and appropriate to this alternative (Table 16).

6.3.2.2 OFF-SITE LANDFILL

The Off-Site Landfill Alternative was determined to comply with Chemical and Action Specific ARARs as outlined in Table 16. There were no Location Specific or To Be Considered ARARs which apply to this remedial alternative.

6.3.2.3 OFF-SITE INCINERATION

The Off-Site Incineration alternative was determined to comply with all the Chemical, Action and Location Specific ARARs. No To Be Considered requirements were identified (Table 16).

6.3.2.4 ON-SITE INCINERATION

The On-Site Incineration Alternative was determined to comply with all the Chemical, Action and Location Specific ARARs. No To Be Considered requirements were identified (Table 16).

6.3.2.5 MULTI-LAYER CAP

The Multi-Layer Cap Alternative was determined to comply only with the CAA and OSHA ARARs.

6.3.3 Long-Term Effectiveness and Permanence

Alternative 2 (Off-Site Landfill), which provides effectiveness through engineering controls, offers the highest degree of effectiveness and permanence by containing the contaminated sediments in an existing permitted off-site landfill.

TABLE 16

Compliance with Applicable or Relevant and Appropriate Requirements

ARARs	ALT. 1 No Action	ALT. 2 Off-Site Landfill	ALT. 3 Off-Site Incineration	ALT. 4 On-Site Incineration	ALT. 5 Multi-Layer Cap
CHEMICAL SPECIFIC ARARs					
TSCA PCB Regulations	No	Yes	Yes	Yes	No
RCRA Hazardous Characteristics	No	Yes	Yes	Yes	No
CWA Pretreatment Requirements	No	Yes	Yes	Yes	No
CAA Air Emissions	N/A	Yes	Yes	Yes	Yes
ACTION SPECIFIC ARARs					
RCRA * Minimum Technology	No	Yes	Yes	Yes	No
CAA Treatment Requirements	N/A	Yes	Yes	Yes	Yes
CWA Pretreatment Requirements	No	Yes	Yes	Yes	No
TSCA PCB Mgmt. Requirements	No	Yes	Yes	Yes	No
OSHA	N/A	Yes	Yes	Yes	Yes
LOCATION SPECIFIC ARARs					
CAA Pretreatment Requirements	N/A	N/A	Yes	Yes	Yes
CWA Pretreatment Requirements	N/A	N/A	Yes	Yes	No
TSCA PCB Mgmt. Requirements	N/A	Yes	Yes	Yes	No
TO BE CONSIDERED REQUIREMENTS					
	— NO ARARs ARE CONSIDERED TO APPLY —				

* **NOTE: Includes consideration of land disposal restrictions and CERCLA exemption provisions for these alternative remedial actions.**

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The incineration alternatives (Off-Site Incineration and On-Site Incineration), would provide for only long-term effectiveness and permanence through destruction of organics and PCBs. However, given the high concentration of potentially volatile heavy metals and low organic fraction of contaminated sediments, incineration alone is not considered to have the same permanence as landfilling.

Moreover, extensive pollution control equipment would be necessary to capture the volatilized metals in the flue gas. Both the ash and the air pollution control equipment residuals would also be more toxic and would require chemical stabilization prior to landfill disposal. Therefore, incineration alternatives have been given a medium ranking with regard to long-term effectiveness and permanence.

Alternative 1 (No Action) and Alternative 5 (Multi-Layer Cap) offer the least long-term effectiveness of all the alternatives evaluated. Long-term monitoring and maintenance would be required to assure the permanence of this remedy.

6.3.4 Reduction of Toxicity, Mobility and Volume

Alternative 2 (Off-Site Landfill) offers a high degree of reduction of mobility by moving the contaminated sediments from their present position and placing them in a secure permitted landfill. No change in the toxicity or volume is anticipated.

Alternatives 3 (Off-Site Incineration) and 4, (On-Site Incineration) offer a negligable degree of reduction of volume. The residue from the incinerator would be 98 percent dry solids. However, the incineration of the heavy metal contaminated sediments will require chemical stabilization of the ash and air pollution abatement residue to reduce mobility and toxicity. This chemical stabilization will increase the volume of the material requiring landfill disposal.

Alternatives 1 (No Action) and 5 (Multi-Layer Cap) offer the lowest degree in reducing toxicity, mobility and volume.

6.3.5 Short-Term Effectiveness

The most advantageous alternatives for short-term effectiveness are Alternative 2 (Off-Site Landfill) and Alternative 3 (Off-Site Incineration) because of their overall environmental impacts and speed with which they can be implemented. Although Alternative 3 would be implemented relatively quickly, its implementation may be slowed by the limited availability of off-site incineration. Alternative 4 would take the longest time to implement because of permitting requirements and construction time.

Alternatives 2, 3, and 5 (Multi-Layer Cap) would provide short-term effectiveness. Installation could be completed within one year, and would quickly minimize exposure pathways such as air and sediment contact. The long-term effectiveness would depend upon the operation and maintenance program. Alternative 1 (No Action) does not change any effects.

6.3.6 Implementability

Alternatives 1 (No-Action) and 2 (Off-Site Landfill) are easily implemented using standard materials, equipment and methods. Although, the pending land disposal restrictions may serve to limit landfilling operations, landfill space is available in Alabama, Utah and Texas for the mixture of PCBs, organics and metals contained in the excavated sediments.

Alternative 4 (On-Site Incineration) cannot be fully implemented without permitting and until a trial burn is conducted. Necessary permits include air and water permits and RCRA and TSCA permits. The permit process could take more than three years. Local opposition to on-site incineration of hazardous materials may also serve to delay and/or preclude obtaining permits. In addition, it is unlikely that conventional mobile incinerators would be equipped with air pollution control equipment needed to treat the volatile metals released during incineration.

Alternative 5 (Multi-Layer Cap) may also be easier to implement but the permitting process would also take several years and may receive local opposition, but is technically easy to implement and is therefore ranked as a medium.

Alternative 3 (Off-Site Incineration) provides a medium degree of implementability. The off-site incineration facilities which may be used have contractual commitments to clients which may result in excessive delays of incineration, especially with increased incineration demands arising from the RCRA land disposal restrictions.

6.3.7 Cost

The cost estimates developed using the Cost of Remedial Actions (CORA)(CH2M Hill, Version 2.1) Model are for use in developing remedial action budgets, feasibility study cost estimates or more detailed cost. The CORA Model cost estimates are developed using project scope information supplied by the user. The final costs of the project will depend on the final project scope, actual labor and materials costs, actual site conditions, productivity, competitive market conditions, final project schedule, and other variable factors. The CORA Model analysis cost estimates are for relative comparison purposes only.

6.3.8 Regulatory Acceptance

Alternatives 2, 3, and 4 are projected to carry a high degree of regulatory acceptance since the creek sediments will be physically removed from their present position and either treated or isolated from human and environmental exposure. Regulatory acceptance is projected to be low for Alternative 1 (No Action). Alternative 5 (Multi-Layer Cap) is projected to carry a medium degree of regulatory acceptance since the creek sediments would only be capped and isolated from human contact.

6.3.9 Community Acceptance

Alternatives 2 and 3 are projected to carry a high degree of community acceptance since the contaminants will be physically removed from the immediate area and either treated or disposed. Alternatives 1, 4 and 5 are projected to carry a low degree of community acceptance since the creek sediments will not be removed from the immediate area.

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7.0 RECOMMENDED REMEDIAL ACTION ALTERNATIVE

The recommended remediation alternative is a removal action that involves the excavation of approximately 20,000 cubic yards of contaminated creek sediment located at varying depths within CS-A.

Excavation of the creek sediments is proposed to be accomplished using dragline equipment based on the banks of the creek within the secured area surrounding CS-A. A dragline bucket, with a capacity of three cubic yards, will scrape the bottom of the creek bed to remove contaminated sediments to the depths observed during the soils boring program.

Excavation would proceed from the south to north of the creek to allow incident precipitation to be collected for discharge into the Sauget sewer system. In order to minimize the handling of the contaminated sediments, the excavated material will be stockpiled within the confines of the creek in diked zones. It is proposed to create a total of six zones by installation of filter fabric across the creek to retain fine sediment particles and promote drainage of the sediments. The stockpiled sediment will remain within the creek banks, but piled above the high water level of the creek and above the groundwater table. In this manner, the sediments will naturally release entrained water without the necessity of mechanical dewatering. Soil boring data obtained during the characterization of the creek sediments indicate that the dried sediments average greater than 80% solids.

To assure that the contaminated sediments are removed from the creek bottom, visual confirmation of the extent of the excavated material will be performed. As observed during the soils boring program, the contaminated creek sediments are dark brown/black in color, and readily discerned from the underlying naturally-occurring Cahokia sand.

Upon excavation of each creek zone, the stockpiled material will be loaded into rail cars for transport to an off-site RCRA-permitted landfill. Depending upon PCB content, the landfill may also be TSCA approved. The excavated zone, now isolated by filter fabric, will be immediately backfilled with clean fill. The final elevation of the backfilled creek will be above the present bank elevations. This backfilled material will be crowned to promote runoff and be graded to allow stormwater to flow from the former creek area to the south and into the stormwater sewer running along Queeny Avenue.

The sediment will contain PCBs with an anticipated average concentration of 28 mg/kg based upon current knowledge and regulatory requirements. The excavated sediments will not constitue a listed hazardous waste. During the sediment characterization, two contaminated samples were subjected to the Toxicity Characteristics Leachate Procedure (TCLP), and did not exhibit the concentration to be classified as a hazardous waste. During the proposed remediation program, all excavated sediments will be subjected to TCLP. Rail car loads will be analyzed on a batch basis consistent with the off-site landfill disposal requirements. In the event that any load of excavated material requires disposal subject to land band restrictions, the material will be treated as required at the off-site disposal facility prior to landfill disposal. In the event that the PCB content of a shipment is greater than 50 mg/kg, the material will be routed to a TSCA approved landfill.

Stabilization of the excavated material prior to shipment is not expected to be necessary. All materials loaded into rail cars will meet the paint filter test by having a greater than 75% solids content and will not release free liquids. The rail cars will be watertight, lined and covered. Based on a minimum 75% solids content, the volume of excavated material shipped off-site will be 10,400 cubic yards.

This removal action, involving excavation and loading of the sediments, does not require any federal or state permits for on-site activities. Cerro has a hazardous waste generator ID number for which will be used to maifest waste shipments as required.

Closure of CS-A will be accomplished by backfilling the creek bed to an elevation above the banks. The top layer of the backfill will be roadmix stone with fines which will be rolled to serve as cap and retard infiltration. Portions of the backfilled material will be within the groundwater table. Use restrictions will be imposed on CS-A to prohibit construction of any buildings or structures that require disturbance of the cap. Use will be limited to non-intrustive activities, such as trailer parking or material storage.

Air releases to the atmosphere during the excavation will be curtailed by dredging beneath the water level in the creek. Vapor-suppressing foam will be used to cover the excavation zone or stockpile areas, as required, if, based upon on-site air sampling, volatile emissions exceed applicable regulatory standards at the site boundary. Rail cars used for storage of the dewatered material and for transport will be covered.

The limits of excavation will be the existing CS-A boundaries set by the high waterline.

Soil boring data within the Old Queeny Road indicated the presence of highly volatile compounds. Review of the boring log for boring A10, however, does not indicate the presence of brown/black contaminated sediment because of the observed contamination depth of 27 feet. It is assumed that the reported concentrations of volatiles and PCBs are the result of interstitial groundwater being contaminated.

Consequently, this remedial alternative has been recommended to meet all applicable statutory requirements, and has been developed consistent with the National Contingency Plan. The work plan developed for the remediation program will consist of a number of work tasks involving the RI/FS Consent Decree, the remedial design and the removal action at CS-A. The IEPA will perform a final review of all material including the Health and Safety Plan and the Quality Assurance Project Plan. A final work plan outline will also be developed to monitor the progress of the remediation program. The completed work plan will be submitted with the approved RI/FS, and will discuss the remaining remediation tasks according to scope, responsibility, duration and necessary documentation to receive IEPA approval of the remediation of CS-A.

Concurrent with the final review of the RI/FS by IEPA, it is proposed to prequalify both consulting engineers and remediation contractors. Upon approval of the RI/FS and the Consent Decree, a contract will be executed with the selected engineering firm to initiate the contract documents including plans and specifications for the remediation program. During the IEPA review of the contract documents, it is proposed to advertise the remediation construction and solicit bids. Contracts will be awarded for the on-site excavation, rail car loading and backfill of CS-A and the rail car transport and off-site landfill disposal. The design period is scheduled for seven weeks and to be completed prior to July 27, 1990. The award of the remediation contracts is scheduled for August 20 1990. Completion of the remediation of CS-A is scheduled for November 12, 1990. Final IEPA approval of the remediation of CS-A is expected by November 26, 1990.

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APPENDIX A

HEALTH AND SAFETY PLAN

FOR

AT-RISK SAMPLING

ON SAUGET SITES AREA, SECTOR A

CERRO COPPER PRODUCTS COMPANY

SAUGET, ILLINOIS

Prepared by:

The Avendt Group, Inc.
432 North Saginaw Street
Third Floor, Northbank Center
Flint, Michigan 48502

SITE DESCRIPTION:

The Sauget Site Area consists of two creek sectors, CS-A and CS-B. The CS-A portion of Dead Creek will be sampled in this sampling event.

Creek Sector A has two smaller sections which are identified as CS-A1 and CS-A2. CS-A1 is the largest section, and lies on the north-northwest section of the Cerro property. This sector is approximately 1,200 feet long and 80 feet wide. CS-A2 is the smaller portion, and is 400 feet long and 80 feet wide. A lift station is located at the northernmost end of the Creek section, and is used to control the amount of flow emanating from the Creek.

The Cerro Copper Products Company facility, located on the west side of the Creek, has owned this property since 1970. Records indicate that waste discharge into the Creek began in the late 1930's. Environmental impacts, such as discoloration of the Creek prior to 1970 and 1971, is indicated in an aerial photograph. A fence was constructed in 1971, that separated CS-A from the Cerro facility.

CS-A lies on the east side of the Mississippi River along the west side of its flood plain, in the town of Sauget, Illinois. It is bounded on the south by Queeny Avenue, on the north by the Alton Southern railroad tracks, and by the Cerro facility and Site I on the west and east, respectively.

Sectors CS-A1 and CS-A2 of Dead Creek both have steep banks, approximately seven to ten feet high. During heavy rains or seasonal wet periods, the Creek waters rise to as much as four to five feet. Surface water flow is intermittent. The creek bed consists of approximately seven feet of sandy silt over medium-fine sands. The creek bank consists of interbedded silty sand and sandy silts. The aquifer level surrounding Dead Creek is as shallow as ten feet, and this area is subject to possible flooding.

The Cerro Copper Products Company facility is located in a heavily industrialized area. Monsanto Company, located north of the Cerro Copper Products Company facility, is the largest chemical industry in the area. Other smaller industries exist northeast of the facility.

Site: Sauget Site Area **Job Number:** 88001

Site Description: See attached sheet.

Location: Sauget, Illinois **Perimeter Established?** Yes

Performed by: The Avendt Group, Inc.

Proposed Starting Date of Site Activity: July 5, 1989

Anticipated Date of End of Site Activity: September 5, 1989

Plan Prepared by: Jeff Kost

Date: June 29, 1989

Objective of Entry: The objective of entry into Sauget Site Area Sectors CS-A1 and CS-A2 is to sample the subsoils in and around the Creek area by boring methods. Surface soil samples will be collected. Site-specific QA/QC and decontamination techniques will be employed throughout the sampling activities. A laboratory following CLP procedure will be utilized to obtain analytical results. The analytical information will then be evaluated for extent of contamination.

Objective of the Health and Safety Plan (HSP): The objective of writing this Health and Safety Plan for the Cerro Copper Products Company site at Sauget is to:

1) Provide measures that will minimize accidents and injuries that may occur during this particular project;

2) Guide the Avendt Group personnel and any others that may be associated during the work sessions;

3) Remind any working personnel at the site of possible dangers and variable weather conditions as well as to provide guidance for normal site operations. Emergency situations that may be experienced include:

a) variety of hazardous/toxic chemicals;
b) biological agents;
c) heat or other physical stresses;
d) equipment-related accidents;
e) fire or explosion creatable by on-site activities;

4) To meet standards as required by OSHA/NIOSH/EPA as contained in 29CFR-1910.120.

Possible Hazards: Volatile organics, semivolatile organics, pesticides/PCBs, inorganics and heavy metals.

Areas Affected: Surface water in the Creek. Soils and sediments proximate to the Creek. Possibly the groundwater.

Topography: The CS--A site is flat with little topographic relief. The main topographic difference is the Dead Creek Channel.

Weather Condition: Summer, temperatures in range of 75 degrees F up to 100 degrees F at 100% humidity.

Additional Information: Will be announced when received by The Avendt Group, Inc.

On-Site Organization and Coordination: The following functions have been assigned, respectively:

Project Team Leader:	Chris Bade
Scientific Advisor:	Jeff Kost
Site Safety Officer:	Chris Bade
Public Information Officer:	
Security Officer:	Cerro Copper Security
* Record Keeper:	Avendt Group Personnel
Financial Officer:	Cerro Copper Personnel
Field Team Leader:	Chris Bade
Field Team Members:	Chris Bade, Jeff Kost, Mark Keyes
Federal Agency Representatives:	
State Agency Representatives:	
Local Agency Representatives:	
Co-Contractor(s):	

* All personnel arriving or departing the site should log in and out with the Record Keeper.

Out-of-bounds Area: Sectors A and B to nine team workers.

Established Command Post/Staging Area: Shower Trailer.

Prevailing Wind Conditions Are: To be determined (TBD).

Upwind/Downwind: TBD.

Exclusion Zone: TBD.

Personal Protective Equipment: Based on the evaluation of the potential hazards, the following levels of personal protection have been designated for applicable work areas or tasks.

Location	Job Function	Protection
Exclusion Zone	Soil Boring/sampling	A
CS-A11-6 and CS-A22 and CS-A21	Soil Boring/sampling	C^a
Downwind of surface flowing water	Surface Water/sampling	C^b
CS-A1s and CS-A2s	Groundwater sampling	C
East/west and north/ south banks of Dead Creek CS-A1 and CS-A2	Surface soil sampling	C

Level C Protection

Requirements for this level of protection include:

- Racal power air purifying respirators (APRs)
- neoprene boots (steel toe and shank)
- Tyvek or Saranax coveralls
- disposable gloves and booties; safety glasses required
- hard hats and neoprene gloves

C^a Ear plugs might be needed during boring activities.
C^b Gloves worn during surface water sampling should be taped at the wrist.

Based on past records, chlorobenzene is one of the volatile organics found in high concentration in Site I. Photoionization detector (PID) will be used to monitor general volatile organic vapor. Bases for level "D" protection using chlorobenzene as a marker, is 75ppm PID reading. 75ppm is the time waited average (TWA)[1] exposure for chlorobenzene vapor. That is the concentration that does not require respiratory apparatus. If PID of VOC[2] reads between 76ppm to 999ppm, Level D protection is required. For PID of VOC 1000ppm and up, Level C protection is required.

Although Level A and B protections are not expected on this job site, Level B respiratory protection level and other protections applicable to B will be needed for a PID above 1875ppm. If PID of VOC reads 2400ppm or above, all protective equipment for Level A must be employed. This is because the immediate danger to life and health (IDLH) level for chlorobenzene is 2400ppm.

In the event of a change in hazardous conditions, the above protection Level will be upgraded to Level B or A or downgraded to protection Level D.

Level A Protection

This level of protection will be required when vapor and gas concentration becomes higher than Level C or B at specific job locations. At such conditions, it will be assumed that there is a potential danger to continue with Level C protection. The following protective equipment is recommended:

- encapsulated suit (for emergency)
- cascade system
- spare air tank
- out-work gloves
- self-contained breathing apparatus (SCBA), in addition to that equipment under Level C protection.

[1] Time waited average based on eight-hour period.
[2] Volatile organic chemicals.

Level B Protection

This level of protection will be used at job functions where Level C protection becomes unsatisfactory. At this event, the following protective equipment will be required in addition to that assigned for Level C protection. They are:

- SCBA
- spare air tank
- booties
- cascade system
- manifold system
- air compressor

Level D Protection

This is the lowest protection level. It is employed where there is not possible potential for exposure to chemical hazards. However, Level D protection is required for safety reasons. The Level D protection will only require the following equipment:

- ultra-twin respirator
- cartridges (types GMC-H, GM-P)
- chemical-resistant overalls
- neoprene safety boots
- booties (latex)
- work gloves
- hard hat and safety glasses

The safety officer and the project team leader are the only personnel authorized to make changes on the recommended level of protection (especially downgrading it) for this job site. This is because they are the ones who possess the expertise on the safety requirements and conditions on related job activities. They are also assigned complete safety control and overseeing of this project activity.

Decontamination Procedure:

Personal: All disposable protective clothing will be bagged, labeled and drummed. Boots and gloves to be washed with Alconox detergent and rinsed three or more times with deionized water.

Equipment: A hollow steam auger with a hand-held high-pressure steam cleaner should be used. The continuous core sampler will be decontaminated between each boring with Acetone, and rinsed three or more times with deionized water.

Site Entry: Depending on daily based weather conditions,

Procedure: Decontamination station is subject to change.

Emergency Medical Care: It is necessary that all the crew members be aware of the following in case of emergency.

First-aid Equipment is available on-site at the following locations:

First-Aid Kit: Shower Trailer.
Emergency Eye Wash: Shower Trailer
Emergency Shower: Shower Trailer
Other: TBA

List of Emergency Phone Numbers

Agency/Facility	Phone Number	Contact
Police (local, County Sheriff, or State)	(618) 277-3500 (618) 332-6500	County Police Sauget Police
Police, Explosive Unit	(618) 346-3600	State Police
Fire	(618) 332-6600	Sauget Fire Department
Ambulance	(618) 332-6793	Braun's Ambulance
Hospital Emergency Room	(618) 874-7076	Gateway Community Hospital
Airport	(618) 337-6060	Bi-State Park Airport Cahokia
Poison Control Center OR	(618) 233-1935 (618) 233-1938	Memorial Hospital
Agency Contact (EPA, State, Local, USCG)	(217) 524-4827	Paul Takacs, IEPA, Hazardous Waste Dept.
Local Medical Laboratory	(618) 235-1780	St. Clair Medical Lab.
Federal Express	(314) 367-8278	6181 Aviation Drive St. Louis Airport
Client Contact	N/A	N/A
Others IEPA Emergency Unit	(217) 782-3637	N/A

Emergency Routes:

Directions to Hospital (include map):

Monsanto Avenue east to Monsanto Road (19th Street in East St. Louis) north on 19th Street to Bond Avenue, west on Bond Avenue to 15th Street, north on 15th Street to King Drive. East on King Drive to Gateway Community Hospital. Routes to be driven by designated site personnel prior to initiating on-site operations.

Directions to BI State Airport: State Route 50 south to Judith Lane. East on Judith Lane to Cahokia Road, south on Cahokia Road to Julian Avenue, east on Julian Avenue to Airport Road.

QA/QC **Precaution**

To maintain quality assurance and quality control measures, all boring equipment (i.e., augers, drilling rods, etc.) should be steam-cleaned after an acetone rinse between borings. Avendt Group personnel will observe the decontamination operation. All dirt and materials must be removed from the auger flights. All rinse and waste water during the boring activities should be disposed per state and federal regulations.* Also to monitor possible contamination, a trip blank prepared from distilled deionized water should be carried throughout the sampling, storage and shipment process. Sample pouring and collection near to exhaust fumes must be avoided.

***Disposal of On-site Generated Waste**

All small amounts of decontamination and rinse solutions must be stored in 55-gallon drums. Larger drums of 110 gallons, 1,000 gallons, etc., will be employed according to the volume of waste rinse solution generated. These could be either associated with personal contamination station or large equipment rinse that must be done in an area that will collect all the spent fluids. The waste rinse containers that can be sealed until ultimate disposal is arranged.

Decontamination and rinse solutions cannot be allowed to drain back on site.

Proper labeling is required on each decontamination rinse solution drums and mud pits. The maximum duration for storing the on-site generated waste is 90 days. Beyond this period, permit and interim status will be required. Details of applicable waste storage, management and disposal of contaminated materials is an RCRA requirement and is found in 40CFR262 entitled "Standard Applicable to Generators of Hazardous Wastes."

IEPA will be contacted at (217) 782-3397 for the applicable state requirements when such a condition arises.

<u>Equipment Check List, Level C:</u>

Ultra-Twin Respirator:	________
Racal power air purifier:	________
Racal cartridge (type GMC-H AEP-3) HEPA filters:	________
Robert Shaw escape mask:	________
Chemical-resistant coveralls:	________

Protective coveralls: __________
Type Saranac hooded: __________
Rain suits: __________
Butyl apron: __________
Gloves (type viton-neoprene): __________
Outer work gloves: __________
Neoprene safety boots: __________
Hard hat with face shield: __________
Hard hat without face shield: __________
Latex disposable booties: __________
Safety glasses: __________

<u>Decon Equipment Check List:</u>

Wash tubs: __________
Buckets: __________
Scrub brushes: __________
Pressurized sprayer: __________
Detergent (type tsp Alconex): __________
Solvent (type, acetone): __________
Plastic sheets: __________
Tarps: __________
Trash bags: __________
Trash cans: __________
Masking tape: __________
Duct tape: __________
Paper towels: __________
Face mask: __________
Face mask sanitizer: __________
Folding chairs: __________
Step ladder: __________

<u>First-Aid Equipment Check List:</u>

First-aid kit: __________
Oxygen administrator: __________
Stretcher: __________
Portable eye wash: __________
Blood pressure monitor: __________
Radiation badges: __________
Fire extinguisher: __________
Thermometers (oval): __________
Walkie-talkie: __________

Van Equipment Checklist:

Tool kit:	________
Hydraulic jack:	________
Gas:	________
Oil:	________
Anti-freeze/coolant:	________
Battery:	________
Windshield wash:	________
Tire pressure:	________
Lug wrench:	________
Tow chain:	________
Van checkout:	________

Instrument Check List:

OVA:	________
Thermal desorber:	________
O_2/explosimeter:	________
Explosimeter calibration kit:	________
HNu W/10-2 EV lamp:	________
RAD mini:	________
Magnetometer:	________
Pipe locator:	________
Weather station:	________
Drager pump:	________
Brunton compass:	________
HNu calibration kit:	________
Monitox CN meter:	________
GCA/MDA particulate monitor:	________

Miscellaneous Check List:

Pitcher pump:	________
Surveyor's tape:	________
100' fiberglass tape:	________
300' nylon rope:	________
Nylon string:	________
Surveying flags:	________
Film:	________
Wheelbarrow:	________
Bung wrench:	________
Soil auger:	________
Pick:	________
Shovel:	________
Catalytic heater:	________
Propane gas:	________
Banner tape:	________

Surveying meter stick:	___________
Chaining pins and ring:	___________
Tables:	___________
Weather radio:	___________
Binoculars:	___________
Megaphone:	___________

Emergency Information

Since there has been background information regarding both volatile and semivolatile organics in the site, the following emergency precautions should be adopted:

	In Case of This <u>(Acute Exposure Symptoms)</u>	Do This <u>(First Aid)</u>
1)	Severe irritation of skin -	Wash irritated areas.
2)	Severe irritation of respiratory system -	Get medical aid.
3)	Accidental ingestion of unknown liquid -	Immediately induce vomiting.
4)	Dust/vapor/liquid contact irritation -	Wash affected areas with suspected and contaminant and skin in soap and water.

Site Resources:

Water Supply: 5-gallon collapsible containers will be used.

Telephone: New Queeny Avenue and Falling Spring Road. Also Route 3 via Cerro Plant Road, and Monsanto Avenue.

Radio: TBA

Other: TBA

Emergency Contacts:

Chris Bade, Regional Safety Coordinator,
(301) 261-1177 office, (313) 658-2048, Home.

MEDTOX Hotline: In case of emergencies that require hotline action:

1) The following should be contacted: Drs. Raymond Harbison, Glenn Milner or Robert James at (501) 370-8263 (24-hour answering services).

2) What to state:

   a) "This is an emergency;"
   b) Your name, region and site;
   c) Telephone number to reach you;
   d) Location of emergency;
   e) Name of person injured or exposed;
   f) Nature of emergency; and
   g) Action taken.

Special Site Precaution:

1) Before any boring is attempted, local utility and surrounding industries (chemical or others) should be contacted to identify (if any) their subsurface transmission lines, cables or pipes. (These have been confirmed.)

2) Care should be taken to minimize stressful conditions resulting from extreme temperatures. Heat and cold stress symptoms should/will be monitored and recorded in the site security log book.

3) Attempts to open drums of unknown contents must be avoided. This is important as to eliminate such explosion hazards.

4) Work will be conducted during daylight hours only.

5) Pre-employment and post-employment physicals are recommended for all personnel to be involved with the on-site job. The physicals must be completed a few days prior to start of work, and upon termination of work. Exposure logs will be maintained as to supplement facts on the subsequent medical checkups.

Site/Waste Characterization:

Waste type(s): Liquid, solid, sludge, corrosive, ignitable, volatile, toxic, reactive, and unknowns have been characterized and associated with the Site I/Creek Sector A subsurface soil samples.

Some specific waste types:

1) Volatile organics to a total of 10 (ten) with chlorobenzene as highest.

2) Total of 25 semivolatile organic chemicals. Those in high concentrations are:

   a) 1,2,4-trichlorobenzene @ 8,300ppm
   b) Hexachlorobenzene @ 1,300ppm
   c) 1,4-dichlorobenzene @ 1,800ppm
   d) Naphthalene @ 10ppm

   Also found were fluoroethene, anthracene, dichlorobenzene, n-nitrosodiphenylamine, etc.

Pesticides/PCBs: Three pesticides and PCBs at the following levels were found:

1) 4,4'DDD @ a concentration of 30ppm
2) 4,4'DDT @ a concentration of 4.3ppm
3) Toxaphene @ a concentration of 490ppm
4) One PCB congener (i.e., arochlor)

Inorganics: Found at high concentrations were chromium, mercury, cyanide, nickel, lead, vanadium and antimony.

Principal Disposal Method: Landfill (area filling), wastepiles, surface impoundments, and open drumming.

- Type and location:

  1) Two disposal pits were identified at Site I, Section CS-A containing waste materials such as oily sand, clay, wood and cinders. Occasional refuse such as cardboard, rubber and cloth were identified.

  2) At Sector B, rubbery wastes and sponge-like materials were found on surface soils. Stagnate water at surface depressions and shallow channels were evidenced at northern half of CSB.

Past investigations detected contaminants in the following media: soils, groundwater, surface water, sediments and air. Primary source of contamination is the soil from waste disposal.